The Financial Crisis and The Geography of Wealth Transfers[*]

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Abstract

This paper studies the geography of wealth transfers during the 2008 global financial crisis. We construct valuation changes on bilateral external positions in equity, direct investment and portfolio debt at the height of the crisis to map who benefited and who lost on their external exposure. We find a very diverse set of fortunes governed by the structure of countries' external portfolios. In particular, we are able to relate the gains and losses on debt portfolios to the country's exposure to ABCP conduits and the extent of dollar shortage.

1 Introduction

Two stylized facts dominate the global economy since 1970: the explosion in cross-border financial flows and positions, and the -more recent- emergence of unusually large current account surpluses and deficits (the so-called 'global imbalances'). In the span of a little less than two generations, the size and structure of international balance sheets has been altered dramatically. Consider the case of the United States (Table 1). Forty years ago , in 1971, as the Bretton Woods system of fixed but adjustable exchange rates teetered on the verge of collapse, the United States was a creditor country, with a positive Net International Investment Position (NIIP) of about 6 percent of U.S. output. More importantly, U.S. gross external claims and liabilities were quite small, at 17 and 11 percent of output respectively reflecting the large direct and indirect costs of cross-border financial transactions. About a third of these cross-border positions took the form of bank loans. Most (80 percent) of the remaining claims were direct investment, while a sizeable share (45 percent) of remaining liabilities were in the form of foreign holdings of US government securities. Fast forward to 2007, on the eve of the worst financial crisis since the Great Depression. By then, the U.S. has become a sizeable debtor country, with a negative NIIP of about 12 percent of output. More dramatically, gross external claims and liabilities soared, respectively, to 119 and 131 percent of output. While cross-border loans still represent roughly a third of cross-border positions, the structure of the rest of the U.S. external balance sheet has become substantially more complex. Debt instruments still account for about half of the remaining external liabilities. However, holdings of US government securities now accounts for only half of that amount. The other half includes corporate debt and, more importantly, structured credit instruments such as US mortgage-backed securities. The composition of gross external claims has changed too, with equity holdings and direct investment each accounting for 40 percent of remaining external claims. The case of the United States is hardly unique. As the seminal work of Lane and Milesi-Ferretti (2001) and Lane and Milesi-Ferretti (2007) has demonstrated, cross-border participations increased tremendously for many countries,

including all advanced economies.

Beyond this common trend, however, countries differ markedly in the structure of their external balance sheet. As Gourinchas and Rey (2007) and others have pointed out, the U.S. external balance sheet displays a very specific pattern: short in 'safe' or liquid securities and long in 'risky' or illiquid ones. Interestingly, these patterns can persist through time, despite the profound structural transformations described above. For instance, the share of 'safe' and liquid securities –defined as bank loans and debt instruments– in overall US external liabilities was 67 percent in 1971 and 63 percent in 2007. Similarly, the share of 'risky' and illiquid securities in gross external claims –defined as direct investment and equity claims– was 54 percent in 1971 and 60 percent in 2007 (see Table 1). What constitutes 'safe' or 'risky' securities may have changed over time, but the overall pattern of *liquidity and maturity transformation* revealed by the analysis of the U.S. external balance sheet did not.

If the U.S. invests abroad in risky assets and funds itself with safe liabilities, two implications follow. First, we expect the US to earn a risk premium. A large body of evidence on this question strongly suggests that it does (see Gourinchas, Rey and Govillot (2010) for recent estimates).[1] Second, and this is the focus of this paper, the US should suffer disproportionate losses in times of crisis, when the value of its risky external financial portfolio collapses relative to the value of its safe external liabilities. As Gourinchas, Rey and Govillot (2010) document, this is indeed the case. Between 2007:4 and 2009:1, the US net foreign asset position deteriorated by 21% of GDP, of which about 16% represents the net valuation loss suffered by the US on its external portfolio (Table 2). This valuation loss amounts to roughly $2,200 billion. Losses were especially acute for US equity and direct investments abroad which shrunk in half over that period while U.S. government debt liabilities increased by almost $1,000 bn, or about 7 percent of output.[2]

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[1]But see Curcuru, Dvorak and Warnock (2008) for a contrarian view.

[2]Some of the decline in equity and direct investment represents net sales of foreign assets by US investors over that period since both US and foreign investors 'retrenched' during the crisis (Forbes and Warnock (2010)). Some of the increase in US government securities liabilities to foreigners also represent net purchases of these instruments over the period.

By construction, if the US is persistently short 'safe' and liquid assets and long 'risky' and illiquid ones, the rest of the world must display -in the aggregate– the exact opposite pattern: long in 'safe' or liquid assets and short in 'risky' or illiquid ones. In normal times, it earns lower return on its safe external claims than it pays on its risky external liabilities. In times of crisis, however, the valuation *loss* of the US represents a valuation *gain* for the rest of the world. In some of our other work (Gourinchas, Rey and Govillot (2010)), we have argued that this pattern of wealth transfer in crisis times and excess returns in normal times can be interpreted as a form or risk sharing between the US and the rest of the world where the US plays the role of a *'global insurer'*. Because of their deep, liquid and historically safe market for government securities, the U.S. exhibit a comparative advantage in liquidity and maturity transformation. Since these attributes have remained largely intact through the modern period, they also help us understand why the US retains its role at the center of the International Monetary System, despite the lack of formal arrangement since the collapse of the Bretton Woods system and why the structure of its external balance sheet, while experiencing profound transformations, still performs essentially the same aggregate liquidity and maturity transformation functions. Unlike earlier explanations emphasizing the role of trade or economic size and network externalities for the determination of the international currency, this interpretation emphasizes instead that it is a combination of domestic financial development, economic size, and the fiscal capacity of the sovereign, that determine whose currency and government security endogenously emerge as reserve currency and reserve asset.[3]

It does *not* follow from the preceding discussion that all countries benefit equally from their exposure to the US. It is well-known, for instance, that the financial crisis, having

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[3]Currency internationalisation has been discussed in various contexts in the literature - see for example Cohen (1971), McKinnon (1979), Krugman (1984), Alogoskoufis and Portes (1993), Matsuyama, Kiyotaki and Matsui (1993), Zhou (1997), Hartmann (1998), Portes and Rey (1998), Rey (2001). The role of the centre country in the international monetary system has mostly been construed as the one of international liquidity provider. Because the medium of exchange function is characterized by network externalities, large economies and economies dominating world trade such as nineteenth century Britain issue the international currency . The importance of network externalities in foreign exchange markets is reflected in their organization around vehicle currencies through which most of the transactions are done.

originated in the subprime segment of the U.S. housing market, propagated to rest of the world partly through the heavy losses some European financial institutions suffered on their holdings of US mortgage-backed securities (Acharya and Schnabl (2010)). Recent work also documents that many emerging market economies concentrated their -growing- holdings of external financial claims in the form of US government securities, which provided a safe haven in the midst of the crisis (Bernanke et al. (2011) and Bertaut et al. (2011)). These two examples illustrate the fact that different countries or regions may choose different locus on the risk-return frontier offered by the menu of US financial assets. Beyond these direct linkages, different countries may also have substantially different *indirect* exposure, through their holdings of third-country assets, themselves differentially exposed to the financial crisis. For instance, some countries may hold equity and debt claims on the European financial sector, and thus be indirectly exposed to US housing risk. Others, as discussed extensively by McGuire and von Peter (2009) in the context of the European dollar shortage, may rely on short-term foreign currency borrowing, exposing themselves to rollover and funding risk and to potentially severe deleveraging. Hence, countries were simultaneously hurt by their exposure to the US financial markets (especially structured credit products) and sheltered from the global financial storm trough their holdings of Treasuries and Agencies debt.

The determinants of international portfolios can be quite complex and it is not the purpose of this paper to explain the heterogeneity of portfolios across countries.[4]. Rather, we take them as given and explore the consequences of the crisis on net and gross foreign asset positions.

Understanding the overall structure of global financial linkages during the financial crisis and the associated wealth transfers requires that we go beyond measuring changes in gross and net foreign positions as recorded in the Net International Investment Position. Instead, one needs estimates of *bilateral* external claims and liabilities and of their change during the crisis. Such data would allow us to answer the following critical question: where did the

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[4]For recent attempts to endogenize the portfolio structures of the US vis a vis the rest of the world, see Mendoza, Quadrini and Rios-Rull (2009) and Gourinchas, Rey and Govillot (2010).

$2,200 billion US wealth transfer go?[5] This paper represents an attempt at answering this question. It produces the first 'heat-map' of the geographic distribution of gains and losses, by country and asset class between 2007:4 and 2008:4 for portfolio and direct investment, such as figure 1. This figure reports gains and losses in billion of US dollar in green and red respectively. Darker red corresponds to countries who suffered larger losses (in excess of $600bn) while darker green colors corresponds to winners with gains in excess of $400bn. It identifies relative winners and losers from the financial crisis, once direct and indirect external wealth transfers are taken into account. To be sure, most countries were badly hit by the crisis and their*total* financial wealth declined massively as we will see shortly. But, at the same time, they made gains and losses on their external asset positions, which are not negligible,even when compared to total wealth losses. Furthermore, external valuation gains and losses differed greatly across countries, so that there are relative losers and relative gainers. For instance, according to figure 1 countries like China, the Eurozone, or Switzerland all suffered external losses, although more moderate than the US, while the UK enjoyed significant net gains on its external position.

In this paper we focus on this heterogeneity, which depends on the geography of cross border linkages. We build on the careful and timely work of Milesi-Ferretti, Strobbe and Tamirisa (2010) who construct a dataset of bilateral gross and net external positions on the eve of the financial crisis for countries and groups of countries accounting for more than 97 percent of global external assets and liabilities.[6] We extend their work along several dimensions. First, we construct quarterly estimates of net and gross bilateral positions from 2007:4 to 2008:4. Second, we present separate estimates of bilateral positions for Brazil, Russia, India, and most importantly, China, by relying on hand collected data of the balance sheet of large state banks, in particular. This enables us to have a more precise mesure of Chinese portfolio debt and equity holdings. Third, we decompose the role of the exchange rates and of asset prices in accounting for the gains and losses on external positions. Finally,

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[5]For an early discussion of this issue see the interesting column of Milesi-Ferretti (2009) in voxeu.

[6]Earlier work by Kubelec and Sa (2010) also constructs bilateral holdings between 1980 and 2005 for a larger group of countries using gravity equations to fill-in some of the positions.

we study of the bilateral determinants of gains and losses during the height of the crisis.

Our analysis is in some ways similar to He, Khang and Krishnamurthy (2010) who studied balance sheet adjustments during the financial crisis. Their analysis focused on the balance sheet of various US financial institutions and changes in holdings of securitized assets. Ours concentrates on the external wealth of nations and changes in bilateral holdings of various broad classes of assets. Both shed light on the evolution of leverage during the crisis.

It is important to emphasize from the outset that data limitations induce substantial uncertainty in an exercise of this nature. High quality data on bilateral positions and flows are not systematically available. Instead, we are forced to rely on a number of empirical assumptions and educated guesses in putting together our database. Important data limitations arise from the limited coverage of bilateral banking transactions at market value; the residence principle that underlies balance of payment data and results in excessively large holdings attributed to custodial and offshore financial centers; and the general lack of data availability for some groups of countries, including offshore financial centers, many middle east oil producing countries as well as some emerging economies. Nevertheless, we believe that despite the necessary inaccuracies implied by our empirical assumptions, some consistent patterns emerge from the data, which will survive the additional empirical scrutiny that we hope will be possible in the near future. We also endeavour to provide several versions of the estimates of gains and losses of countries, some multilateral, some bilateral, some which includes off shore centres, some which ventilates their positions across countries, some based on FDI estimated at market value, some where FDI is at current cost, etc... in order to do robustness checks.

Our exercise reveals a number of important findings. First, as exemplified in figure 1, we see large valuation changes during the crisis period, varying widely across countries. Most countries made capital gains on their portfolio equity positions in the crisis as they were either short on equity overall (like the UK, who made a gain of about $284 bn –see Table 3) or held equity assets whose value declined less than equity liabilities during the crisis. On

the other side, taking the capital loss, is of course the US, who is long equity and made very large losses on its portfolio equity position ($1,153bn, according to table 3). The structure of the external debt portfolio, in particular whether debt assets are mostly government bonds or corporate bonds or asset backed mortgage securities, is also a crucial determinant of the valuation gains and losses. Countries who self-insured by holding mostly foreign government bonds tended to limit their losses or even post gains on their net debt portfolios, while countries who levered heavily to invest in risky asset backed mortgage securities or other toxic assets experienced losses on their net debt. We find a clear positive correlation in the data between the countries with losses on their net debt portfolios and those who set-up ABCP conduits. Though the sample coverage is relatively small, we also find a positive correlation between countries who set up ABCP conduits and the McGuire and von Peter (2009) measure of US dollar shortage, suggesting that the lack of dollar liquidity in the banking system was associated with important losses on external debt portfolios.

The next section reviews the evolution of the external balance sheets of the countries in our sample, puts them in perspective by comparing them to changes in total wealth of countries. We provide a world map of external losses and decompose the effect of exchange rates and asset prices on capital gains and losses. Section 3 discusses our empirical methodology to construct bilateral gross and net positions for portfolio and direct asset holdings, for which we have the most detailed data and presents the 'heat map' of bilateral gains and losses by asset class. Section 4 relates the distribution of wealth transfers to observable determinants, such as the exposure to asset backed commercial paper (ABCP), the overall dollar shortage as well as to measures of the regulatory environment. Section 5 concludes.

2   External Balance Sheet Adjustments

We begin our analysis by reviewing the evolution of the *aggregate* external balance sheet for a large sample of countries from the end of 2007 to the end of 2008. This period covers the most acute phase of the crisis during the fourth quarter of 2008 following the collapse of

Lehman Brothers, and is therefore the most relevant from the perspective of wealth transfers.

The recovery in many asset markets around the world in 2009 did reverse some of the wealth transfers documented in this paper, perhaps as a result of the coordinated and aggressive macroeconomic policies that may have helped stabilize the world economy. What interests us here is a measure of the external wealth transfers resulting directly from the crisis itself, i.e. measured at a time when the possibility and the effectiveness of coordinated countercyclical policies remained remote and the risk of a second Great Depression was on everyone's mind. It would be interesting to quantify the impact of these external transfers on the recovery path of the real economy across countries. Such an entreprise however goes well beyond the current paper. One difficulty consists in controlling for the relative size of the shocks hitting the various economies. Another lies in the endogeneity of the policy responses. Instead, this paper focuses on the determinants of the relative gains and losses on the external positions of countries and put those valuations in perspective by comparing them to the contemporaneous changes in domestic household wealth.

2.1   Data and Methodology

Our sample includes most industrial countries (Canada, the Euro area, Japan, Switzerland, the UK, the US), a group of other advanced economies (Australia, Denmark, New Zealand, Norway and Sweden), some major emerging economies (Brazil, China, India, Russia, Singapore, Hong-Kong) and a group of emerging Asian economies composed of Indonesia, South Korea, Malaysia, the Philippines and Thailand. Missing from this sample are oil exporters and offshore financial centers, both with potentially large gross and net cross-border positions.[7] For each country in the sample, we construct an estimate of the aggregate valuation gain/loss as:

$$VA_t^i = NA_t^i - NA_{t-1}^i - CA_t^i,$$

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[7]See Lane and Milesi-Ferretti (2009) for some estimates of offshore financial centers net asset positions. We will use some bilateral data on offshore financial centres in section 3 and assess the robustness of our results when we include them in our bilateral estimates of valuations.

where NA_t^i denotes the net foreign asset position at time t for country i and CA_t^i the current account balance during period t. We further break down the net foreign asset position into net direct investment, equity, portfolio debt and other assets (mostly bank loans), according to $NA_t^i = \sum_c NA_t^{i,c}$ where $NA_t^{i,c}$ represents the net position of country i in asset class c at time t. Using the balance of payment identity, we can write the valuation term as the sum of the changes in the net asset position by asset classes, $\Delta NA_t^{i,c}$, corrected for the net financial flows in asset category c over the period, denoted $NF_t^{i,c}$.[8]

$$VA_t^i = \sum_c \Delta NA_t^{i,c} - NF_t^{i,c}. \tag{1}$$

2.2   Aggregate gains and losses

We collect quarterly and annual data on foreign assets and liabilities, at market value whenever possible, with corresponding financial flows, for this set of 11 individual countries and 3 country groups between 2007 and 2009. Assets and liabilities positions are broken down into the following assets classes: portfolio debt, portfolio equity, direct investment, other investment and reserves (with matching flows, but excluding financial derivatives). For debt, equity, direct investment and other investment positions we rely on national sources for Canada, China, the Euro Area, Japan, Switzerland, United Kingdom and the United States whereas for all other countries data are from the IMF Balance of Payments Statistics. For reserves we use "Total reserves minus gold" obtained from the IMF International Financial Statistics. All flow data were obtained from the IMF Balance of Payments Statistics.[9]

We first offer a geographical 'heatmap' of aggregate gains and losses around the globe in figure 1. As mentioned previously, countries with darker red colors bear the larger losses (in excess of $600bn). The lighter red color represents smaller losses. Similarly, countries with dark green color enjoyed the largest gains (in excess of $400 bn) while lighter green represents smaller gains. Countries in plain white, such as, for example, African countries,

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[8]The sum of net financial flows equals the current account balance, up to errors and omissions and unilateral transfers and remittances, which we ignore in this decomposition.

[9]For more details on our data see the Appendix.

are those for which we have no data. At a glance, we can see that most of the external valuation losses are spread across the US, the Euro Area, Switzerland and China (Australia and other advanced economies made very moderate losses). The UK on the other hand is at the other end of the spectrum and made large capital gains on its net external asset position, while Brazil, Russia and India made moderate gains.

Tables 3 reports the corresponding numerical estimates (all the numbers are in billions of US$) and figures 2-3 present the corresponding heatmap for each asset class (debt, equity, FDI and foreign exchange) with the same color coding. Finally, figure 4 reports the breakdown of gains/losses by asset class and country. For each country, or group of countries, this last figure reports VA_t^i (the solid line) as well as the various components $\Delta NA_t^{ic} - NF_t^{ic}$ according to equation (1).[10]

Figure 4 also includes the valuation gain/loss for the 'rest of the world' (RoW), defined as the counterpart of the aggregate valuation term in our data: $VA_t^{\text{row}} = -\sum_i VA_t^i$. This valuation term accounts both for incomplete geographical coverage as well as any measurement error. Accordingly, its interpretation should be subject to extra caution.

For the purpose of comparability across countries, we constructed figure 4 and Table 3 with US direct investment positions measured at *current cost*. This brings down the overall US valuation loss between 2007:4 and 2008:4 from -$2,069bn when using direct investment at market value as in Table 1 and 2, to -$863bn.[11]

A number of important features emerge from the data. First, the simple proposition that the US suffered a valuation loss while other countries gained uniformly is not supported by the data. The Euro area, mainland China and Switzerland all experienced sizeable losses, of $185bn, $158bn and $53bn respectively whereas the U.K ($542bn), Russia ($317bn), Brazil ($292bn) and emerging Asia ($245bn) were the main net beneficiaries. Taken together, the countries of our sample –outside the US– experienced a positive wealth transfer of $1,145bn

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[10]For table 3 and 4 we grouped debt and foreign exchange reserves in the debt category.

[11]The valuation component on US net direct investment at market value is -$1,150bn and $56bn at current cost. By construction, the difference, equal to $1,206bn, must be accounted for by valuation gains on net direct investment (at market value) in other countries. The next section will provide rough estimates of bilateral direct investment positions at market value.

exceeding the \$863bn losses of the U.S, the difference being attributed to the rest of the world.

Second, most of the US losses arise from the \$1,153bn decline in its net equity portfolio. By construction, the cross section distribution of valuations within each asset class sums to zero, that is for each asset class c:

$$\sum_i VA_t^{i,c} = 0,$$

where $VA_t^{i,c} = \Delta NA_t^{i,c} - NF_t^{i,c}$. Inspection of table 3 and figure 4 reveals that the counterpart of the US net equity losses were widely distributed, most countries realizing gains on their equity portfolio, especially the Euro area (\$506bn), the UK (\$284bn), Russia (\$208bn), Brazil (\$205bn), emerging Asia (\$192bn) and Japan (\$176bn). In all these countries, the gains arise from a drastic reduction in the value of equity liabilities, relative to equity holdings. All these countries had short cross border equity positions as of 2007.

Third, the gains/losses attributable to US cross-border portfolio debt holdings are relatively small, all of the increase in debt liabilities (\$505bn) being more than accounted for by gross capital inflows (\$591bn) especially into US government securities. The small associated valuation loss on US portfolio debt liabilities (-\$86bn) underlies the relative stability of U.S. government securities during the crisis. By contrast, the U.K., experienced a valuation gain of \$339bn on its net debt position, largely due to the decline in the value of its debt liabilities (-\$515bn), some of which can be attributed to the decline in the value of the Sterling relative to the US dollar during that period. Conversely, the Euro area suffered large valuation losses on its external debt claims (-\$461bn) most likely related to the collapse in the value of its portfolio of US structured credit products. Overall, the contrast between these three countries is consistent with the US issuing safe public debt and risky private-label debt (see Bernanke et al. (2011)); the Euro area holding a portfolio of risky private-label debt assets; the U.K issuing Sterling denominated debt and risky private-label debt both of which declined in value during the crisis.

Fourth, despite large holdings of U.S. public securities China suffered an overall negative wealth transfer during the crisis ($158bn), representing about 3.5 percent of its output. China also suffered a $61bn loss on its foreign exchange reserve holdings, as a result of the markdown on its non-dollar reserves when most currencies lost ground against the US dollar.[12] [13]. These findings highlight that the decline in China's net external wealth would have been much more pronounced, were it not for its large holdings of US government securities.

Taken together, the results from table 3 and figure 4 reveal a remarkable pattern. If we define *ex-post global insurers* as the set of countries that provided significant positive transfers to the rest of the world during the financial crisis, this set includes the following countries: the United States ($863bn, 6 percent of GDP), the Euro area ($185bn, 1.36 percent of GDP), Switzerland ($53bn, 10.6 percent of GDP) and China ($158bn, 3.5 percent of GDP).[14] The channels through which each of these countries experienced valuation losses vary. For the US, it is the collapse in its long net equity position, relative to its short debt position, which did not decline nearly as much. For Switzerland and the Euro area, it is the decline in the value of their debt holdings, which were infested by toxic assets, and the decline in the value of their long direct investment position. For China, as discussed above, it is the losses on the non-dollar components of its foreign exchange reserves, due to a dollar appreciation.

These findings indicate that the heatmap of gains and losses is substantially more complex than expected. In particular, it suggests that it is incorrect to think of the United States as

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[12]We measure gains and losses in dollars. If we measured valuation effects in a currency basket instead, such as the SDR, China would record a gain of about 2.6 bn SDR on its official foreign exchange holdings, as the SDR depreciated against the dollar at the height of the crisis. Except for this "level effect" the choice of a numeraire has no consequence on our results.

[13]The official IIP figures also indicate increases in the value of Chinese FDI and equity liabilities. These numbers are however not at market value. Given that the Chinese stock market suffered a massive decline during the crisis, Chinese liabilities are likely to be overstated in official IIP data. Hence, Chinese losses are likely to be also overstated. In the next section of the paper we discuss in more details the shortcomings of Chinese data.

[14]Technically, the list should also include Singapore ($56bn valuation loss representing 29 percent of its output). However, Singapore is a regional financial center and discrepancies between claims and liabilities lead to us to interpret these numbers with caution.

the single provider of global liquidity. The allocation of losses is still extremely asymmetric –with the US accounting for about 68 percent of the cross border wealth losses, the Euro area for 15 percent, China for 13 percent and Switzerland for 4 percent.[15] Nevertheless it provides perhaps an early indication that the global economy may have already moved towards a *multilateral system*, where the provision of global liquidity is not concentrated in the hands of the United States any longer. On the whole, our results are also consistent with the recent work emphasizing the resilience of emerging economies during the recent crisis (see Kose and Prasad (2010) and Gourinchas and Obstfeld (2011)).

2.3   Exchange rate accounting, total wealth and valuations

The crisis period has been characterized by large gyrations in exchange rates, with, in particular a susbtantial appreciation of the dollar against most currencies. It is interesting to decompose gains and losses on external balance sheets into fluctuations in asset prices (equity, FDI, bond prices) and exchange rate movements. We attempt here such an accounting exercise in order to assess how much exchange rate movements explain our change in valuations.

We use the geographical distribution of bilateral weights of assets and liabilities as well as some crude assumptions on their currency composition to compute the relevant exchange rate movements. In particular, we assume that all FDI and equities holdings are in the currency of the issuer and that all bank loans are fully hedged and hence immune to exchange rate effects. We use the Lane and Shambaugh's exchange rate weights for the debt data.[16]

Our results presented in table 4 have striking features. All the countries we identified

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[15]For the reasons mentioned above and discussed in more details below, the numbers for China are likely to be very imprecise. The share of the US losses in total losses would be even larger if we measured direct investment at market value since the US valuation loss would be roughly three times as large.

[16]In our benchmark case, we assume that all the assets that our source countries own in offshore centers are in US dollars. This may be a problematic assumption for some of our countries, like the UK, which have susbtantial links with offshore centres and is likely to use sterling for at least part of these transactions. As a robustness check, we assumed that all the UK assets vis-à-vis all offshore centers are in Sterling. The only large difference is for the exchange rate valuation on FDI assets: instead of incurring a loss $80 bn, the UK would incur a lot of $156 bn. While not negligible, this is unlikely to change our results in a material way (UK offshore FDI assets are only 15% of total UK FDI assets).

in the previous section as *ex post global insurers* (US, Euro Area, Switzerland, China and Singapore, with the addition of Japan) suffered valuation losses due to adverse exchange rate movements. These are countries whose currencies have tended to hold rather well or even to appreciate at the height of the crisis mainly due to their role as safe havens. Liabilities of these countries are mainly in domestic currency and their assets mainly in foreign currencies, hence an appreciation of the domestic exchange rate tends to decrease the value of their net foreign assets. Our Table shows that exchange rate movements account for about 31% of US external valuation changes (when US FDI is measured at market value). This sizable number (corresponding to a valuation loss of about $650 bn) is not surprising as the currency composition of US external assets and liabilities is very asymmetric: almost all US liabilities are in dollars while about two thirds of US assets are in foreign currencies. As the dollar appreciated sharply in 2008 in part due to inflows into the Treasuries market, the value of US external claims went down. For Switzerland and Japan, the losses stemming from the strength of their currencies were partly compensated by an increase in the value of their external claims. Both Switzerland and Japan have short equity positions and benefit from a collapse in equity prices. A contrario, the Sterling collapse led to large exchange rate gains on the UK net external positions. Those gains explain 139% of the total valuation changes, meaning that they were partly offset by decreases in the value of UK net external assets

One legitimate question to ask is whether the international wealth transfers this paper focuses on are relevant compared to the change in domestic financial wealth that occured during the crisis. We report in table 4 (columns (7) and (8)) changes in total domestic household wealth for the subset of countries for which we could find data.[17] First, declines in wealth are indeed very large during the period we consider: $17.3 trillion for the United States, $2.7 trillion for the UK and $2.3 trillion for Japan, $1.3 trillion for the eurozone. This should come as no surprise as our period spans the height of the financial crisis during which many financial and real estate markets performed dismally. External valuation gains

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[17]Source: OECD Economic Outlook (2011). Our data cover the US, the UK, the Euro Area (limited here to Germany, Italy and France), Japan and Canada.

or losses, though smaller, are nevertheless quite sizeable as a proportion of total wealth changes. Their absolute value range from 3% (for Japan) to 20% for the UK, reflecting both the openness of the UK as a small open economy and the important role of London as an international financial centre. For the US, external valuation changes amount to 12% of the change in total household wealth, and for the Euro Area 14%. Hence, while there is no doubt the negative domestic wealth effects dominate the macroeconomic landscape for most of our countries, the international wealth transfers, determined by the heterogeneity of external balance sheets, are far from being negligible.

3   Bilateral valuation gains and losses

Our world maps showed considerable geographical heterogeneity in external wealth changes at the country level. We now refine our analysis and estimate the distributions of *bilateral* valuations gains and losses during 2007-2008. Balance of payment data and international investment positions are based on the concept of residency. This concept is not fully adequate to analyze risk sharing in the international economy. Ideally, we would like to have data on final ownership of assets. These data do not exist for portfolio investment or FDI however, for which we will have to assume that residency and ownership coincide. The presence of important financial links with offshore financial centres, which act merely as intermediate financial platforms distort further the geographical picture of our data.[18] All our results are therefore subjected to these limitations. A second important difficulty is the estimation of bilateral investment positions and bilateral flows in different asset classes. Kubelec and Sa (2010) and Milesi-Ferretti, Strobbe and Tamirisa (2010) have done pioneering work in trying to estimate bilateral investment positions. Nevertheless, data limitations remain severe in terms of country coverage in particular and availability of data at market value (see the appendix for a more detailed discussion of data issues).[19]

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[18]For an attempt to assess the robustness of our results to the inclusion of offshore centres, see next section.

[19]We chose not to compute bilateral financial matrices for bank loans. The locational banking statistics of the BIS, based on the concept of residency, give data on bilateral banking positions. These data however

3.1 Data and Methodology

For each asset class, we estimate the bilateral distribution of valuation gains and losses VX_{t+1}^{ij} at time $t+1$ between country i and j during the height of the crisis between 2007 Q4 and 2008 Q4. We derive VX_{t+1}^{ij} using the following accounting identity:

$$VX_{t+1}^{ij} = PX_{t+1}^{ij} - PX_t^{ij} - FX_{t+1}^{ij}, \tag{2}$$

where PX_t^{ij} denotes the holdings of country i in country j at time t, and FX_t^{ij} represents the net financial purchases by residents of country i in country j in the asset class considered between t and $t+1$.

Yearly data on some components of bilateral international portfolios holdings by asset classes are available through the CPIS survey and other sources in recent years for a number of countries. Bilateral flow data coverage is, however, generally far from complete or not available. We use the following methodology to estimate bilateral flows on quarterly data.[20]

Portfolio debt and portfolio equity

We compute the bilateral portfolio weights w_t^{ij} of country i vis-a-vis country j for a given asset class at date t using bilateral CPIS data as: $w_t^{ij} = PX_t^{ij} / \sum_{j \in CPIS} PX_t^{ij}$. The coverage of the CPIS data is not exhaustive, hence the sum of all the bilateral positions of country i for portfolio debt or equity covered by the CPIS does not correspond to the reported aggregated IIP for these assets. Accordingly, we construct a *coverage rate* for country i at date t as $\alpha_t^i = \sum_{j \in CPIS} PX_t^{ij} / PX_t^i$, where PX_t^i is the reported aggregate (multilateral) international investment position for country i.[21] We denote the aggregate flow in a given asset class by

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are bound to be of little use for our purposes as loan books and large parts of the banking books are not marked to market. The speed of write downs and the provisioning for bad loans have differed widely across countries and it is unclear how much of this is reflected in the BIS numbers of 2007-2008. Furthermore, there are large differences between consolidated statistics and locational statistics, suggesting that the concept of residency, compatible with balance of payment accounting is bound to be very different from the ultimate geographical distribution of gains and losses. Rather than attempt a heroic effort at reconciling loan data on a bilateral basis, we preferred not to do bilateral financial matrices for this asset category.

[20]We provide all our data sources for specific countries in the appendix. When CPIS data are not available (as in the case of China) we use national data sources.

[21]We make sure that the valuation methods for the numerator and the denominator are the same.

FX_{t+1}^i, and estimated variables with a 'hat'. Our goal is to construct an estimate of the quarterly bilateral flows $F\hat{X}_t^{ij}$. Our working assumption is that the geographical distribution of flows over each quarter corresponds to the portfolio weights at the beginning of the quarter. Scaling total flows in proportion to the data coverage on the positions, it results that our estimated bilateral flows are constructed as:

$$F\hat{X}_{t+1}^{ij} = w_t^{ij} \ FX_{t+1}^i \ \alpha_t^i.$$

An estimate of next quarter's positions (ex-valuation gains) can then be constructed as:

$$P\hat{X}_{t+1}^{ij} = PX_t^{ij} + F\hat{X}_{t+1}^{ij}$$

The procedure is then iterated by defining the next quarter portfolio weights as $\hat{w}_{t+1}^{ij} = P\hat{X}_{t+1}^{ij} / \sum_{j \in CPIS} P\hat{X}_{t+1}^{ij}$ and using these to construct the following quarter bilateral flows etc...

We recover the yearly valuation term in the fourth quarter, VX_{t+4}^{ij}, as the difference between end of year bilateral positions as recorded in the available surveys, adjusted for our constructed cumulated bilateral flows:

$$
\begin{aligned}
VX_{t+4}^{ij} &= PX_{t+4}^{ij} - \sum_{s=1}^{4} F\hat{X}_{t+s}^{ij} - PX_t^{ij} \\
VX_{t+4}^{ij} &= PX_{t+4}^{ij} - \alpha_t^i \sum_{s=1}^{4} \hat{w}_{t+s-1}^{ij} FX_{t+s}^i - PX_t^{ij},
\end{aligned}
$$

where the second line substitutes $F\hat{X}_{t+s}^{ij}$ for its empirical counterpart. We emphasize again that this approach is quite crude, given the data limitation and is likely to suffer from a number of shortcomings. However, in the absence of more detailed data, it strikes us as reasonable to assume that flows are allocated proportionally to observed positions.[22]

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[22]One simple case where our assumption would be violated is one where investors would want to maintain fixed portfolios shares. In that case, investors would rebalance fully their portfolio every period, which would require underweighting assets that outperform, so that the financial flows would not be exactly proportional to beginning of period holdings. Our rule assumes that investors do not follow such a simple, full rebalancing rule; indeed at the observed frequencies, portfolio weights are time varying.

Bilateral FDI

For our sample, up-to-date official data on FDI at market value is only available for the following countries: the US, Hong Kong, Japan, Australia and Sweden.[23] In order to obtain bilateral FDI positions at market value we rely wherever possible on official estimates of the aggregate FDI positions at market value. For countries that do not report such estimates, we update an initial market value estimate by using equity price indices and aggregate FDI flows. Once we have the derived - or provided - estimate of the aggregate market value FDI stock for 2007 and 2008, we use the ratio of market value to book value of the aggregate stock to infer the bilateral FDI stocks at market value.

For the US, the BEA provides market value of the aggregate FDI stock which we use to convert the bilateral BEA FDI positions at historical cost to market value. The same method is used for Japan (where market value estimates are provided by the Bank of Japan) and Sweden (with data from the Swedish Rijksbank).

For the UK, Switzerland, Denmark, Canada and China we rely on an initial estimate of the aggregate FDI positions at market value which we update by using destination country equity indices and aggregate direct investment flows. We rely on Kubelec, Orskaug and Tanaka (2007) for UK direct investment positions as of 2005; Kumah, Damgaard and Elkjaer (2009) for Denmark in 2006; Stoffes and Tille (2009) for Switzerland in 2005 and Statistics Canada for Canada in 2005 (see the appendix for a more detailed discussion of our market value estimation methodology). For the remaining countries in our sample we rely on bilateral DI positions at market value derived from partner countries sources. With these estimates of yearly positions in hand, we construct bilateral FDI flows and valuations using the same approach as for portfolio debt and equity.

Bilateral Foreign exchange data

For the currency composition of foreign exchange reserves we use national sources (Canada, Russia, Switzerland and the UK) or else adopt the 2007 currency share of official reserves

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[23]Of those, only Australia and Hong-Kong use market value as the primary FDI valuation method in their official IIP release.

provided in Milesi-Ferretti, Strobbe and Tamirisa (2010) for 2008. For China, the currency composition of reserves is usually not disclosed. We use the 2010 weights, as this is the only year for which data are available. While this strategy is by no means optimal, we believe any resulting errors to be comparatively small, in view of the relative stability of foreign reserve currency shares over time.

Bilateral FX reserves valuations are computed using exchange rate movements applied to the currency composition of reserves. We prefer this direct valuation method as flows are bound to be very badly observed (reserve flows are kept confidential by some countries), while exchange rate movements and currency composition are relatively accurate.

Treatment of offshore financial centres

The main offshore centres are in our sample.[24] Though the reporting is spotty (see Lane and Milesi-Ferretti (2009) for a thorough study) there are some important cross border positions between some offshore centres (such as the Cayman Islands and the Bahamas, for example) and advanced economies. It is very unlikely that the ultimate owners of financial assets bought by offshore centres are actual residents of off-shore centres. Rather, offshore centres act as intermediaries to channel funds across the globe, reflecting, among other things, tax "optimization" and tax evasion. Zucman (2011) shows that a significant amount of rich countries wealth seem to evaporate via those channels.

Because, by design, the traceability of the geography of financial flows emanating from and going into offshore centres is limited, we make two different assumptions in the course of our analysis and investigate the robustness of our results. First we simply take the offshore centres out of the bilateral financial matrices. This means that we focus only on the financial linkages across countries that are explicitly (even if imperfectly) recorded in official data. Second, we assume that the bulk of offshore financial transactions is done to go around domestic fiscal authorities, legally or illegally. Hence most of those transactions are really domestic transactions intermediated offshore. We therefore redistribute offshore

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[24]These include Aruba, Andorra, Bahamas, Barbados, Bermuda, British Virgin Islands, Cayman Islands, Gibraltar, Guernsey, Isle of Man, Jersey, Lebanon, Liechtenstein, Macao, Mauritius, Monaco, Netherland Antilles, Panama, Samoa, San Marino, Vanuatu, Vatican, West Indies

centres external assets and liabilities to the other countries of our samples in the following way. Take the US-Bahamas example. We assume that part of the external assets of the US towards the Bahamas are actually US-US investments and we ventilate the rest according to the weights of the US portfolio on external assets. Specifically we use the home bias of the US equity portfolio to determine how many US-Bahamas claims are really US domestic claims. On the liability side, we do a similar breakdown: US liabilities vis-a-vis the Bahamas are assumed to be US-US liabilities (same home bias weight) and the remainder is ventilated according to the weights in the US external liability portfolio.[25]

While these assumptions on offshore centers have some effect on the results, especially for the countries which trade most with offshore centers, such as the US, the UK and the euro area, the overall pattern of transfers does not change, whether in the aggregate or by asset classes.[26] We conclude that while there is no denying offshore centres introduce some degree of uncertainty in the geographical distribution of gains and losses, the relative magnitudes are such that they probably are not large enough to significantly alter our global heatmaps.

3.2 Bilateral Financial Matrices

Traditionally, the propensity of countries to experience a financial crisis has been linked to large current account deficits and net imbalances. As financial globalization proceeds, cross border asset positions are growing at a rapid rate, and balance sheet effects are becoming increasingly important: even countries with net balanced positions and no current account deficit can become financially illiquid. Nowadays, financial fragility has to be assessed through information on gross external asset positions, disaggregated by asset classes. Tracking the process of international transmission of financial shocks involves knowing the network of bilateral gross exposures of countries. Hence, we believe that the construction of bilateral matrices such as the ones we are presenting in this paper for the 2007-2008 crisis,

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[25]The home bias weights for equity and bonds are taken from Coeurdacier and Rey (2010). For FDI, we use the same home bias weights as for the equity portfolio.

[26]Bilateral financial matrices with ventilation of offshore positions are not reported here due to lack of space. They are available upon request.

can be of great interest to understand better systemic risk and the propagation of shocks at the international level. In what follows we present bilateral financial matrices on gains and losses by asset categories (portfolio debt, equity and FDI).

There are several ways of constructing valuation matrices. We can use data on bilateral assets and liabilities of reporting countries or alternatively use data based only on the asset side of reporting countries. Because data on the asset side is usually more reliable (see Milesi-Ferretti, Strobbe and Tamirisa (2010) for a discussion), this is what we present in this section.

Matrix of bilateral valuation gains and losses on the net equity portfolio

Each matrice presents in columns the source country and in rows the destination countries. Hence if we look at the bilateral ventilation of portfolio equity assets (table 5), in the first column and second row (Brazil- Canada), the number 4,079 means that Brazil is making a valuation gain of $4,079 millions on its net equity asset portfolio vis-a -vis Canada (and conversely that Canada is making a valuation loss of the same amount in the first row/second column of the table). The numbers across the diagonal are symmetric as we used exclusively assets data. Several facts are noteworthy. First, despite the difference in coverage and the assumptions we had to make when constructing the data, the sum of our bilateral valuations (equal to $162,796 millions for Brazil) is usually reasonably close to the total valuations computed directly from aggregated net positions in Table 3. In principle, the two numbers should not necessarily be equal since the latter includes all countries while the bilateral coverage in Table 5 is more limited. Nevertheless, the numbers should be close if the omitted countries do not account for a significant share of cross-border equity positions. For the United States, for instance, the two numbers are strikingly close (-$1,218 billions versus -$1,153 billions).[27] Second, we uncover a remarkable geographical pattern of gains and losses. As risky assets valuation plummeted during the crisis, the United States, with

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[27]For other countries, the sum of our bilateral valuation effects can differ substantially. The discrepancy is largest for China where aggregate equity data indicate a small valuation loss of $12 billions, while our cumulated bilateral valuations report a gain of $186 billions. Besides measurement issues, the difference could be due in part to valuation losses that China experienced against countries not included in our sample.

long equity positions vis-a-vis each of the other geographical entities in our sample, suffered across the board losses. Furthermore, after controlling for their bilateral equity portfolio gain against the US, all other advanced economies except Japan also made losses on their net equity position, reflecting their overall short equity position vis-a-vis the US and long position against the rest of the world. The case of the UK is particularly interesting. It registers one of the biggest gain on its portfolio equity ($198 billions) and is characterized by a massive short position vis a vis the US and a somewhat smaller short position vis a vis the Euro Area and Canada. Emerging markets, on the other hand, tend to be short equity vis a vis most of their partners, and as a result, benefited from the worldwide fall in equity markets. This is particularly clear for the BRIC countries (Brazil, Russia, India and China) who make gains on most of their bilateral net equity positions.

Matrix of bilateral valuation gains and losses on the net debt portfolio.

The data on portfolio debt presented in table 6 show bigger gaps in coverage than the equity data. In particular, the data coverage for the Euro area and the UK seems particularly limited, as revealed by the comparison between the sum of bilateral gains and losses and the aggregate figure obtained directly from the IIP iin Table 3. Data coverage for the United States seems adequate since we report a valuation loss of $58 billions while the aggregate position indicates $46 billions. It would be ideal to be able to distinguish between government debt and corporate debt, including structured credit products Unfortunately this breakdown is not available. Hence the net valuation on the debt portfolio will depend on the relative weights of US treasuries, say, versus asset-backed mortgage securities in countries portfolios. As indicated, our matrice also does not include official reserve holdings with the data on debt (unlike Table 3 above which aggregated the two). According to Bernanke et al. (2011), saving glut economies such as China and Emerging Asia have concentrated their portfolio holdings into government bonds, pushing downwards their yields and inducing more advanced economies, in particular the euro area to invest in higher yielding securities, such as ABCP. Our data seem consistent with this narrative, as the Euro Area has a large long position in US debt in 2007, which translated in large losses during the crisis. Similarly, other advanced

economies, Canada, Switzerland, who were also long in US debt and had presumably a similar portfolio structure as the Euro area made losses on their net debt liabilities. A noticeable exception is the UK, who, despite a long position in US debt realized a massive gain, due mainly to the collapse of the value of US debt assets in the UK. The US makes gains on its net debt portfolio vis a vis most advanced economies (except the UK) and conversely makes losses vis a vis Russia and Hong Kong, which are likely to have accumulated more US government bonds than corporate debt.

Matrix of bilateral valuation gains and losses on the net FDI portfolio

Comparing the sum of our bilateral net valuations for FDI at market value presented in Table 7 with the aggregate data on valuation estimated from reported IIP, our data coverage is clearly limited for some areas.[28] The Euro area coverage in particular seems most problematic, since the sum of bilateral valuations indicates a gain of $575 billions, while the corresponding aggregate figure in Table 3 is a loss of $334 billions. It seems unlikely that the discrepancy, a valuation loss in excess of $1,000 billions, could be accounted for purely by the gaps in our geographic coverage, especially vis-a-vis other emerging markets. With this caveat in mind, the results on bilateral direct investment still present some interesting features. Japan has net DI assets vis-a-vis all the countries in our sample, except Switzerland. Consequently, it suffered bilateral losses against each country (except Switzerland and India). Similarly the US made large losses vis-a-vis the Euro area against which it holds a large long position. UK FDI in the US seems to have particularly underperformed and is responsible for the gain that the US makes on its net FDI portfolio vis a vis the UK.

Matrix of bilateral valuation gains and losses on the foreign exchange reserves

Since the dollar is the dominant reserve currency, using the dollar as the numeraire would lead to many entries being zero.[29] For this matrix (and only this one), we therefore chose

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[28]Note that for this matrix, we constructed market value FDI estimates wherever possible (see Appendix). Thus, the data presented here differs from the data presented in Table 3, where, e.g. for the US we used FDI at current cost to allow for better comparability across countries and, similarly, most other countries use book values to compile their aggregate FDI data. In consequence, the sum of bilateral valuations in Table 7 is not directly comparable with the aggregate figures in Table 3.

[29]We assume that currency and residency coincide, i.e. Chinese holdings of US$ reserves are assets of

to express valuations in terms of the SDR basket in Table 8. For the 2006-2010 period, the SDR weights were 44% dollar, 34% euro, 11% yen, 11% sterling. Since the SDR depreciated against the US dollar and the yen in 2008, countries holding reserves predominantly in US $ and /or yen have seen their official reserves appreciate, when measured in SDR. For example, China made moderate net gains on its foreign reserves during this period, because of the strengthening of the dollar and the yen. China made some losses on its euro and, even more sizably on its sterling reserves. Russia, on the other hand suffered net losses due to its exposure to euro and sterling assets. So did the euro area, as it is heavily exposed to sterling assets.

4 Determinants of gains and losses

It is now well understood that before the crisis, a number of AAA-rated securities (mostly asset-backed mortgage securities) were perceived as perfect substitutes for US government securities. Following Bernanke et al. (2011), let us call them 'private-label' safe assets. Eventually, the safety of the private label assets proved illusory, and their price spiralled downwards during the crisis. By contrast, US Treasuries held-up remarkably well and even saw their price rise due to inflows of capital seeking safe haven protection (see McCauley and McGuire (2009)). Acharya and Schnabl (2010) estimate that the banks around the world manufactured over $1,200 billion of these 'private-label' safe assets by selling short-term Asset-Backed Commercial Paper (ABCP) via conduits to risk-averse investors and investing the proceeds primarily in long-term U.S. securities. As liquidity in the dollar money markets dried-up in 2007, many banks found themselves unable to roll over these ABCP and forced to reinstate the mortgages from the conduits on their balance sheet, with significant losses. Bilateral exposure data are ideal to investigate the macroeconomic impact of those investments by commercial banks, i.e. whether countries whose banks set up large asset-backed commercial paper conduits also experienced large losses on their external debt portfolios,

China on the US. As there are few reserve currencies, there are already a large number of zeros in this matrix.

as measured by the "Survey on Portfolio holdings of U.S. Securities". Figure 5 illustrates the positive correlation between the share of ABCP conduits in total external debt positions as of 2007 and the rate of losses made on external debt portfolios between 2007 Q4 and 2008 Q4.[30] Though the sample is small, the correlation is strikingly positive, suggesting that setting up ABCP conduits is a major determinant of aggregate losses on external debt. Furthermore, there is a strong mapping between the geographical distributions of losses and the share of the various areas in total ABCP holdings. As pointed out in Bernanke et al. (2011), the Euro area leveraged massively to invest in those private-label safe assets ending up holding 40% of total outstanding ABCP and as a result saw massive deline in the value of its external debt to the tune of 54% of total losses (Figure 5). The UK, who held 16% of the total stock of ABCP bore 21% of total losses.

Reinforcing the plausibility of the mechanism described above linking prevalence of ABCP conduits and liquidity dry ups entailing losses on assets, we find a strong positive correlation between the measures of dollar shortage in some banking systems developed by McGuire and von Peter (2009) and the propensity of those systems to set up ABCP conduits. Figure 6 uses the upper limits of the dollar shortage measures developed by McGuire and von Peter (2009) both at the office and at the group level. Those measures are constructed by assuming that net interbank borrrowing in dollar, net borrowing on the FX swap markets in dollars (which the authors back out from the balance sheet identity assuming no open positions on the forex), dollar borrowing from official monetary authorities, as well as liabilities to non banks are all short term. The difference between those short term dollar liabilities and the longer term dollar assets gives the dollar funding gap or dollar shortage of a country banking system.[31] With the exception of Switzerland, which did not appear to have any significant

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[30]We are very grateful to Viral Acharya and Philip Schnabl for sharing their data with us. Their dataset consists in the following countries: Australia, Austria, Belgium, Canada, Denmark, Frecnh, Germany, Italy, Japan, Netherthelands, spain, Sweden, Switzerland, UK, USA.

[31]We are grateful to the authors for providing us with their data, whose construction is described in McGuire and von Peter (2009). The group-level estimates are constructed by aggregating banks' global balance sheets into a consolidated whole, and then calculating funding risk on this aggregated balance sheet. The office-level estimates are constructed by calculating funding risk at the office location level, and then aggregating the series up across office locations for each banking system. By construction, the office level estimates should at least be as large as the corresponding group level.

exposure to ABCPs in 2007, there is a very clear link between measures of dollar shortage and ABCP conduits.

Finally, we report in Figure 7 the total valuation losses together with the Kaufmann, Kraay and Mastruzzi (2010) indicator of the quality of the regulatory environment. Recent research by Giannone, Lenza and Reichlin (2011) finds that the severity of the crisis was strongly and robustly *positively* related to the degree of liberalization in credit markets, as measured by indicators or 'regulatory quality'.[32] In our sample, the correlation between losses and the Kaufmann, Kraay and Mastruzzi (2010) indicator of the quality of the regulatory environment.is also positive (0.45) and visual inspection confirms that countries with more liberalized credit markets tended to suffer larger valuation losses on their external portfolio. One may conjecture, that the most deregulated markets where also the ones in which investors "splurged" the most and increased their loadings on (once lucrative) toxic assets.

5 Conclusion

The global crisis of 2007-2009 led to massive changes in relative asset prices. We construct a dataset that allows us to analyze the geography of wealth transfers during the crisis. The 'heatmap' we produce highlight a very diverse set of outcomes depending on the structure of the structure of countries' external portfolios. Some saw the value of their net assets plunging, others benefited from large capital gains. The countries whose net international asset positions deteriorated provided wealth transfers to the others at a time where marginal utility of consumption was very high. For that reason they can be regarded as "global insurers", as suggested in Gourinchas, Rey and Govillot (2010). Interestingly, we find that the United States, the country at the centre of the international monetary system and issuer of the main reserve assets, the US Treasuries, provided most of the insurance during the crisis, as its international investment position deteriorated massively. But other countries, which

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[32]For group of countries, we assign the regulatory quality index as follows: Germany for euro area, St Kitts for offshore centers, Saudi Arabia for oil exporters, Thailand for emerging Asia, Norway for other advanced countries, and Peru for other latin-american countries.

may be regarded more like regional insurers joined in, such as Switzerland, the Euro area or even China. A general pattern in our data is that most countries long equity or direct investment faced losses on their net positions, as risky assets took some of the sharpest valuation falls in the crisis. For portfolio debt, the exact structure of portfolio matters, and in particular the relative weights of government bonds versus toxic corporate debt made an important difference for the outcomes. We find that some correlation of exposure to ABCP conduits -mostly in US dollars, existing dollar shortage measures, and losses on the debt portfolio. Finally our exercise, just like Milesi-Ferretti, Strobbe and Tamirisa (2010) underlines important data issues regarding cross country coverage of international investment positions and flows.

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	1971:3	2007:2
Gross Liabilities	11.2	130.8
Bank Loans	3.1	38.8
Debt	4.4	44.2
of which:		
Government	3.7	21.2
Corporate	0.8	23.1
Equity	2.6	22.2
Direct Investment	1.2	25.6
Gross Asset	16.9	119.1
Gold	1.1	1.2
Bank Loans	5.3	36.1
Debt	1.4	10.0
Equity	0.7	35.0
Direct Investment	8.4	36.5
Net	5.7	-11.7
Safe & Liquid/Liabilities	66.6	63.5
Risky & Illiquid/Assets	53.9	60.0

Table 1: US External Balance Sheet, percent of US GDP. FDI at market value. Source: Gourinchas, Rey and Govillot (2010)

Positions as of:	2007:4	2009:1	Change	
	% of GDP		% of GDP	bn (US dollars)
Net	-10.2	-31.4	-21.1	-2,966
of which				
cumulated current account			-5.5	-767
valuation change			-15.7	-2,199
Gross Liabilities	132.6	113.3	-21.6	-3,040
Bank Loans	38.9	34.8	-4.8	-669
Debt	46.0	48.8	2.1	288
of which:				
Government	22.3	29.7	7.0	987
Corporate	23.7	19.2	-5.0	-699
Equity	22.6	13.5	-9.5	-1,333
Direct Investment	25.2	16.2	-9.4	-1,326
Gross Asset	122.5	81.8	-42.7	-6,006
Gold	1.5	1.7	0.2	22
Bank Loans	36.2	35.4	-1.4	-200
Debt	11.1	8.8	-2.5	-353
Equity	36.7	17.0	-20.4	-2,866
Direct Investment	36.9	19.0	-18.6	-2,609

Table 2: Change in US External Balance Sheet. Percent of US GDP. 2007:4 to 2009:1. FDI at market value. Source: Gourinchas, Rey and Govillot (2010)

Country	Valuation	Equity			Direct Investment			Debt			Loans		
		Claims	Liab.	Net	Claims	Liability	Net	Claims	Liab.	Net	Claims	Liab.	Net
U.S.	-863	-2,398	-1,245	-1,153	-161	-218	56	-120	-86	-34	149	-119	268
Euro area	-185	-1,171	-1,677	506	-607	-273	-334	-461	-135	-326	-394	-363	-31
U.K.	542	-567	-851	284	-423	-337	-86	-176	-515	339	-332	-337	5
Japan	65	-244	-420	176	7	46	-39	-66	126	-193	419	298	121
Switzerland	-53	-197	-220	23	28	77	-49	-45	-6	-39	13	2	11
Canada	17	-261	-189	-71	-78	-131	53	-24	-41	18	-7	-25	18
Other advanced	-3	-434	-401	-33	-221	-234	14	-135	-142	8	-101	-111	10
Brazil	292	-2	-207	205	7	-67	74	8	-15	23	-3	7	-9
India	20	0	-18	18	0	-24	24	-25	0	-24	-1	-3	3
Russia	317	-1	-209	208	-220	-350	130	-18	-18	0	-50	-29	-21
Emerging Asia	245	-54	-246	192	-10	-67	57	-24	-8	-16	-35	-48	13
China	-158	1	13	-12	16	64	-48	-61	-2	-59	-22	17	-39
Hong Kong	101	-258	-237	-21	-300	-421	122	7	2	5	-8	17	-4
Singapore	-56	-80	-74	-5	-27	-22	-6	-31	0	-31	-15	-4	-15
Rest of the World	-282			-314			32			329		0	-329

Table 3: The Geography of Wealth Transfers, 2007:4-2008:4. Decomposition of the valuation change into a net equity, net direct investment, net debt and net bank loans components. FDI as in official figures; US FDI at current cost

Country	Exchange rate valuation				External valuation	Exchange/External	Wealth change	External/Wealth
	FDI	Equity	Debt & FX	Total				
United States*	-322	-363	35	-650	-2,069	31%	-17,352	12%
Euro area**	-243	100	17	-127	-185	69%	-1,335	14%
United Kingdom	252	430	73	755	542	139%	-2,714	-20%
Japan	-68	-352	0	-420	65	-647%	-2,340	-3%
Switzerland	-63	-64	-16	-144	-53	271%		
Canada	72	49	16	137	17	807%	291	6%
Other advanced	113	91	21	225	-3	-7502%		
Brazil	59	72	-3	129	292	44%		
India	20	20	-8	33	20	164%		
Russia	91	61	-22	130	317	41%		
Emerging Asia	71	86	-26	130	245	53%		
China	-49	-8	-31	-88	-185	55%		
Hong Kong	17	-8	-6	3	101	3%		
Singapore	-21	-8	-4	-33	-56	58%		

Table 4: Exchange rate valuations, total external valuations and wealth changes The table shows the share of valuation changes accounted for by the exchange rate and the size of total external valuation changes relative to domestic wealth changes. * denotes FDI at market value. ** for the wealth variable, only Germany, France and Italy. Billions of US dollars.

	Brazil	Canada	China	Em. Asia	Euro	H.K	India	Japan	Oth. adv.	Russia	SGP	Switz	U.K.	U.S.
Brazil	0	-4,079	613	-2,710	-36,836	-7	0	-3,948	-4,062	-1	-256	-1,070	-9,537	-100,903
Canada	4,079	0	1,160	7,864	41,309	2,763	1,727	7,233	3,063	1,927	1,211	707	35,989	-89,550
China	-613	-1,160	0	-13,372	-29,698	-64,464	-8	-11,264	-1,309	-7	-1,407	-623	-23,307	-36,921
Em. Asia	2,710	-7,864	13,372	0	-46,681	6,134	3,555	406	-7,059	-75	-9,175	-1,383	-22,144	-113,855
Euro	36,836	-41,309	29,698	46,681	0	22,587	46,872	52,977	-48,374	37,099	2,930	-40,352	53,355	-302,371
H.K.	7	-2,763	64,464	-6,134	-22,587	0	1,159	-7,547	-5,406	11	-5,422	-811	8,031	-53,478
India	0	-1,727	8	-3,555	-46,872	-1,159	0	-4,536	-4,156	0	-8,074	-312	-25,972	-52,799
Japan	3,948	-7,233	11,264	-406	-52,977	7,547	4,536	0	-494	3,428	4,067	-328	-29,373	-93,657
Other adv.	4,062	-3,036	1,309	7,059	48,374	5,406	4,156	494	0	6,113	-707	10,273	12,967	-23,622
Russia	1	-1,927	7	75	-37,099	-11	0	-3,428	-6,113	0	-528	-3,431	-11,482	-54,779
SGP	256	-1211	1407	9175	-2930	5422	8074	-4067	707	528	0	-355	-811	-25,941
Switz.	1,070	-707	623	1,383	40,352	811	312	328	-10,273	3,431	355	0	-14,341	-45,710
U.K.	9,537	-35,989	23,307	22,144	-53,355	-8,031	25,972	29,373	-12,967	11,482	811	14,341	0	-225,292
U.S.	100,903	89,550	36,921	113,855	302,371	53,478	52,799	93,657	23,622	54,779	25,941	45,710	225,292	0
Sum	162,796	-19,455	184,152	182,060	103,371	30,476	149,152	149,678	-72,848	118,715	9,747	22,365	198,669	-1,218,878

Table 5: Matrix of bilateral valuation gains and losses on the net equity portfolio. The table reports the bilateral valuation gain(+)/loss(-) between 2007:4 and 2008:4, for each source/partner pair. Source countries are in columns, partner countries in rows. Millions of US dollars.

	Brazil	Canada	China	Em. Asia	Euro	H.K.	Japan	Other adv.	Russia	SGP	Switz.	U.K.	U.S.
Brazil	0	-322	0	2,293	-7,961	4	3,502	-1,089	-2	-14	195	-2,682	3,367
Canada	322	0	-2	160	2,352	-109	-3,998	2,493	36	-96	1,107	1,224	2,342
China	0	2	0	-15	7,436	3,298	-2,712	-48	5	644	1	345	-15,445
Em. Asia	-2,293	-160	15	0	-23,596	-3,135	2,637	2,694	-28	-18,134	303	-4,892	6,787
Euro	7,961	-2,352	-7,436	23,596	0	-9,263	-78,117	1,803	5,793	-6,851	-7,479	29,244	58,566
H.K.	-4	109	-3,298	3,135	9,263	0	-13,138	7,678	-86	733	360	-16,618	-3,044
Japan	-3,502	3,998	2,712	-2,637	78,117	13,138	0	-14,909	300	812	-1,828	-8,095	15,930
Other adv.	1,089	-2,493	48	-2,694	-1,803	-7,678	14,909	0	735	-5,619	-1,904	-17,100	2,347
Russia	2	-36	-5	28	-5,793	86	-300	-735	0	-93	-64	-7,411	-2,353
SGP	14	96	-644	18,134	6,851	-733	-812	5,619	93	0	27	1,787	2,355
Switz.	-195	-1,107	-1	-303	7,479	-360	1,828	1,904	64	-27	0	9,691	3,598
U.K.	2,682	-1,224	-345	4,892	-29,244	16,618	8,095	17,100	7,411	-1,787	-9,691	0	-132,915
U.S.	-3,367	-2,342	15,445	-6,787	-58,566	3,044	-15,930	-2,347	2,353	-2,355	-3,598	132,915	0
Sum	2,709	-5,829	6,489	39,802	-15,464	14,910	-84,038	20,163	16,673	-32,786	-22,573	118,409	-58,464

Table 6: Matrix of bilateral valuation gains and losses on the net debt portfolio. The table reports the bilateral valuation gain(+)/loss(-) between 2007:4 and 2008:4, for each source/partner pair. Source countries are in columns, partner countries in rows. Millions of US dollars.

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	Brazil	Canada	China	Em. Asia	Euro	H.K.	India	Japan	Oth. adv.	Russia	SGP	Switz.	U.K.	U.S.
Brazil	0	10,200	-339	n.a.	n.a.	n.a.	n.a.	-5,876	-4,287	na	n.a.	-6,426	-3,623	-44,398
Canada	-10,200	0	779	2,524	-12,770	2,460	8,075	-10,354	5,723	547	1,987	-7,519	-14,077	-70,157
China	339	-779	0	-3,236	3,125	-85,816	-29	-28,202	-2,139	1,743	8,819	-1,350	-2,353	-4,089
Em. Asia	n.a.	-2,524	3,236	0	n.a.	-316	n.a.	-56,466	-6,453	n.a.	8,703	-6,452	-18,515	-47,748
Euro	n.a.	12,770	-3,125	n.a.	0	n.a.	n.a.	-143,819	25,293	n.a.	7,348	-62,018	-96,831	-315,257
H.K.	n.a.	-2,460	85,816	316	n.a.	0	n.a.	-6,970	-2,306	n.a.	1,476	-1,887	-52,641	-37,307
India	n.a.	-8,075	29	n.a.	n.a.	n.a.	0	1,197	-428	n.a.	4,522	-1,101	-5,575	-9,530
Japan	5,876	10,354	28,202	56,466	143,819	6,970	-1,197	0	22,311	117	18,526	-3,886	34,718	69,084
Other adv.	4,287	-5,723	2,139	6,453	-25,293	2,306	428	-22,311	0	2,395	369	-3,247	-30,125	2,788
Russia	n.a.	-547	-1,743	n.a.	n.a.	n.a.	n.a.	-117	-2,395	0	n.a.	-2,148	-13,027	-7,739
SGP	n.a.	-1,987	-8,819	-8,703	-7,348	-1,476	-4,522	-18,526	-369	n.a.	0	-7,624	-5,403	-90,158
Switz.	6,426	7,519	1,350	6,452	62,018	1,887	1,101	3,886	3,427	2,148	7,624	0	-2,869	-9,019
U.K.	6,323	14,077	2,353	18,515	96,831	52,641	5,575	-34,718	30,125	13,027	5,403	2,869	0	25,355
U.S.	44,398	70,157	4,089	47,748	315,257	37,307	9,530	-69,084	-2,788	7,739	90,158	9,019	-25,355	0
Sum	54,749	102,981	113,969	126,535	575,639	15,963	18,962	-391,361	65,534	27,716	154,935	-91,770	-235,677	-538,175

Table 7: Matrix of bilateral valuation gains and losses on the net FDI portfolio. The table reports the bilateral valuation gain(+)/loss(-) between 2007:4 and 2008:4, for each source/partner pair. Source countries are in columns, partner countries in rows. Source/partner pairs with bilateral direct investment positions unavailable at market value are denoted with n.a.. Millions of US dollars.

	Brazil	Canada	China	Em. Asia	Euro	H.K.	India	Japan	Other adv.	Russia	SGP	Switz.	U.K.	U.S.
Brazil	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Canada	0	0	0	0	0	0	0	0	0	0	0	0	0	0
China	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Em. Asia	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euro	-501	-256	-5,392	-1,581	0	-207	-1,036	-2,258	-1,134	-2,682	-571	-283	-391	-284
H.K.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
India	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Japan	0	94	8,166	4,451	845	544	852	0	1,353	664	2,294	791	783	4,426
Other adv.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Russia	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SGP	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Switz.	0	0	0	75	172	9	13	0	0	0	37	0	0	0
U.K.	0	0	-12,626	-8,682	-5,982	-721	-2,615	0	-855	-7,548	-1,926	-734	0	0
U.S.	1,786	241	12,472	1,662	1,805	1,531	2,076	9,802	733	2,751	1,122	156	186	0
Sum	1,284	71	2,620	4,075	-3,160	1,156	-710	7,544	97	-6,815	956	-70	577	4,143

Table 8: Matrix of bilateral valuation gains and losses on the foreign exchange reserves. The table reports the bilateral valuation gain(+)/loss(-) between 2007:4 and 2008:4, for each source/partner pair. Source countries are in columns, partner countries in rows. Millions of SDR.

Appendix

A   Countries and regional groups

Individual countries:
Brazil, Canada, China, Hong Kong, India, Japan, Russia, Singapore, Switzerland, United Kingdom, United States

Regional groups:
Emerging Asia: Indonesia, Korea, Malaysia, Philippines, Thailand.
Euro area: Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Slovenia, Spain.
Other advanced countries: Australia, Denmark, New Zealand, Norway, Sweden.

Country groups that are only included as a vis-à-vis category:
Offshore centers: Aruba, Andorra, Bahamas, Barbados, Bermuda, British Virgin Islands, Cayman Islands, Gibraltar, Guernsey, Isle of Man, Jersey, Lebanon, Liechtenstein, Macao, Mauritius, Monaco, Netherland Antilles, Panama, Samoa, San Marino, Vanuatu, Vatican, West Indies.
Oil exporters: Algeria, Bahrain, Gabon, Iran, Iraq, Kuwait, Libya, Nigeria, Oman, Qatar, Saudi Arabia, United Arab Emirates.
Other Latin American countries: Argentina, Chile, Mexico.

B   Data Appendix

B.1   Aggregate positions and flows

International Investment Position (except foreign exchange reserves): we rely on national sources for Canada (Statistics Canada), China (State Administration of Foreign Exchange (SAFE)), Euro Area (European Central Bank), Japan (Bank of Japan), Switzerland (Swiss National Bank), United Kingdom (Pink Book) and the United States (Bureau of Economic Analysis). Data for all other countries were obtained from the IMF Balance of Payments database.

Foreign exchange reserves: we use "total reserves minus gold" available from the IMF International Financial Statistics database.

Financial flows: IMF Balance of Payments statistics

B.2   Bilateral positions

The data construction closely follows Milesi-Ferretti, Strobbe and Tamirisa (2010). We collect annual bilateral positions data for end-2007 and end-2008.

Brazil

FDI: reported bilateral FDI assets and liabilities are measured at book value. To obtain market value estimates of Brazil's bilateral direct investment positions, we use market value data derived from partner countries' reported assets and liabilities vis-à-vis Brazil. Bilateral positions are imputed from the following countries: Australia, Canada, China, Denmark, Japan, New Zealand, Norway, Sweden, Switzerland, United Kingdom and the United States.

Portfolio equity and debt: based on reported and derived portfolio equity/debt assets and liabilities available in IMF Coordinated Portfolio Investment Survey tables 1.1, 1.2 and 5.1, 5.2.

Foreign Exchange Reserves: following Milesi-Feretti et.al. (2010), the US dollar share of total reserves is estimated as the difference between US debt liabilities vis-à-vis Brazil and Brazil's debt assets in the US as reported in the CPIS. The remainder is assumed to be held in euros.

Canada

FDI: we use the data on Canadian direct investment abroad and foreign direct investment to Canada by country and sector available from the Office of the Chief Economist of the Canadian Ministry of Foreign Affairs and International Trade (http://www.international.gc.ca/economist-economiste/statistics-statistiques/investments-investissements.aspx?lang=eng)

Portfolio equity and debt: based on reported and derived portfolio equity/debt assets and liabilities available in IMF Coordinated Portfolio Investment Survey tables 1.1, 1.2 and 5.1, 5.2.

Foreign exchange reserves: we use the currency composition of reserves published by the Canadian department of Finance (http://www.fin.gc.ca/pub/oir-ro-archives-eng.asp)

China

China does not report the geographical allocation of its portfolio investment holdings, as it does not take part in the CPIS. We investigated details national sources and hand collected data to remedy this shortcoming. International Investment Position data are not at market value in official sources (SAFE). We construct data on bilateral equity assets and liability and market value as well as data on debt assets. We also manage to reconstruct bilateral FDI assets and liabilities at market value using Ministry of Commerce data. We reconstructed bilateral data on Chinese external assets at market value from various Chinese data sources.

FDI Assets: The only market value estimates of Chinese FDI have been done in 2004.This was the first survey ever been done on Chinese FDI. After 2004, government agencies added up flow data to estimate the official IIP. Therefore, the official IIP of 2005-2011 are not at market value.

We obtain Ministry of Commerce data with a very good geographical breakdown. The aggregate numbers are not exactly identical to the IIP SAFE numbers as the Ministry of Commerce has a different statistics standard from SAFE. The data are at market value so we use the 2004 stock (based on survey data) and cumulate flows using the corresponding stock indexes for valuation adjustment.

FDI Liabilities: We use the 2004 stock (based on survey data) and cumulate flows using the Shanghai stock index for valuation adjustment.

Portfolio debt: Portfolio debt is held mainly by 5 Chinese state-owned international banks (Bank of China, Industrial and Commercial Bank of China, China Construction Bank, Agricultural Bank of China, Chinese Development Bank) and the sovereign wealth fund CIC. We have a detailed geographical decomposition of cross border claims (into Hong Kong, Other Asia Pacific locations, North and South America, Europe, Middle East and Africa) , and separately, a currency breakdown (RMB, dollar, euro, HK dollar, yen, CHF and other) of overseas loans and of securities held for the Bank of China[33]. In 2010, the total amount of cross border claims for BoC is 1,260,10 millions RMB while the amount of non RMB assets is about double at 2,526,5777 millions RMB. This indicates that a sizable amount of the domestic assets of the BoC are in foreign currency. Making a set of straightforward assumptions[34], we are able to construct for 2007-2010 a table of cross border security holdings disaggregated by country and currency. The Bank of China is historically the main player overseas (Bank of China has been ranked No. 3 in 2009 within all banks in the world by market capitalization). We have a coarser set of data for the three other banks (ICC, CCB, ABC). We obtained as detailed data as possible from the banks report. For the other banks (except CDB), we could obtain data only on their cross border claims by locations. We apply the Bank of China weights to allocate assets between investment securities and total claims, by location, thereby constructing a table of securities by location[35]. For CDB, we obtained secuirties by currencies. We allocated the dollar securities to the US and the (small) remainder of overseas currency securities to Hong Kong.

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[33]We have a breakdown into: derivative financial assets; loans and advances to customers (net); investment securities (broken down in available for sale ; held to maturity and loans and receivables) and other assets. We present in our spreadsheet all the source data we gathered. We work with the assumptions that all the investment securities are debt securities. In principle they could also be equities. In 2007-2008 however we have the exact amount of portfolio equity bought by all our 5 banks via the QDII system (see below for the construction of portfolio equity assets). This amount is less than $4 bn, so we treat it as negligible (the order of magnitude of our total debt asset numbers are in the range of $200 bn).

[34]The data indicate that there is more Hong Kong dollar assets than claims to Hong Kong, more dollar assets than claims to North and South America, less euro and sterling assets than claims to Europe, less yen assets than claims to other Asia Pacific location. We make the following assumptions: all Hong Kong claims are in HK$; all euro and sterling assets are to Europe, all yen assets are to "other Asia Pacific"; all North and South America, Middle East and Africa claims are in $. Any remaining Europe claims not in euro or sterling are assumed to be in $, any other Asia Pacific claims not in yen are assumed to be in US $. We compute the share of investment securities in total US $ assets and use this weight to derive securities holdings in dollar portfolios, for all geographical areas.

We focus on the investment securities part of the claims (securities available for sale; held to maturity and loans and receivables) of the bank balance sheet. We do not use here the data on loans. We check that the total amount of US $ securities we obtain for cross border holdings is inferior to the total amount of reported US $ securities in the total assets of the bank. For example for 2010, the amount of US $ denominated cross border securities we estimate is 105, 883 millions RMB and the reported US dollars securities of the bank amount to 290,943 millions RMB. The difference is therefore domestic holdings of US $ denominated securities.

[35]We give below the market capitalization of the four largest stated owned banks in China.The Bank of China (BoC), the Industrial and Commercial Bank of China (ICBC), the China Construction Bank (CCB) , the Agricultural Bank of China (ABC). These are the only banks having significant international activity and its is clear that the Bank of China is by far the most international one.

Banks: (2010)	Bank of China	ICBC	CCB	ABC
Total Assets (million RMB)	10,459,865	12,779,711	10,810,317	10,337,406
Cross border claims (million RMB)	1,260,170	381,982	272,829	82,254
overseas assset ratio	12.0%	3.9%	2.5%	0.8%

We have data on fixed income holdings for CIC but we do not have explicit geographical data. We are told however (private communication with Chinese sources) that it is almost all US debt.

It is our belief that the union of these five banks and CIC cover the universe of Chinese investors in international debt assets (foreign exchange reserves are accounted for separetely).

Portfolio debt liabilities: We do not have any direct source for debt liabilities and have to take the official IIP numbers. The amount involved are very small (in the order of 20 times smaller than debt assets according to the IIP data).

Foreign exchange reserves: The currency composition of the Chinese reserves is not disclosed. Netheveless, we have one snapshot of the currency weights. In September 2010, the *China Securities Journal* revealed the following breakdown for the $2,450 billion reserves of the People's Bank of China: 65% in dollars, 26% in euros, 5% in sterling, and 3% in yen. We assume that these weights are similar in 2007-2008, as they are likely to be slow moving (by doing so we probably slightly underestimate the dollar share in 2007-2008). For the aggregate amount of reserves we use total reserves minus gold from IFS.

Portfolio equity assets: Equity investment overseas is strictly regulated. QDII is a quota system for domestic investors to hold equity abroad. We obtained a record of all authorized investments in foreign equity for the years 2006-2010. from SAFE. According to Chinese sources, most of the investment reported in QDII is in equity, ETFs or commodities. Unfortunately, we have the breakdown by domestic investor name but not disaggregated by geographical area of investment. However, the amounts involved are very small due to QDII having been launched only in 2006. Besides, China does not have many wealth management services to help Chinese invest in overseas equity markets. For 2006, the total flows amount to $9,675 million, for 2007 $30,544.7 million and for 2008 $3,255 million. Furthermore, private communication with Chinese sources indicate that about 50% of the QDII allocation is equity out of which about 40% is in the Hong Kong market 5% to the US and 5% to Singapore. We value the remaining QDII assets using a global commodity price index (Source IMF: PALLFNF_Index).

We have detailed data on the geographical location of the equity holdings of the sovereign wealth fund CIC. It is our belief that CIC and QDII cover the entire spectrum of portfolio equity investment overseas.

Portfolio equity liabilities: We use partner country data.

Emerging Asia

FDI: reported bilateral FDI assets and liabilities are measured at book value. To obtain market value estimates of Emerging Asia's bilateral direct investment positions, we use market value data derived from partner countries' reported assets and liabilities vis-à-vis Emerging Asia. Bilateral positions are imputed from the following countries: Australia, Canada, China, Denmark, Hong Kong, Japan, New Zealand, Norway, Singapore, Sweden, Switzerland, United Kingdom and the United States.

Portfolio equity and debt: based on reported and derived portfolio equity/debt assets and liabilities available in IMF Coordinated Portfolio Investment Survey tables 1.1, 1.2 and 5.1, 5.2.

Foreign exchange reserves: We use the 2007 currency composition in Milesi-Ferretti, Strobbe and Tamirisa (2010), netting-out the Taiwan-US debt liabilities position from the

Milesi-Ferretti, Strobbe and Tamirisa (2010) bilateral USD FX position. For 2008, we assume that the currency share is unchanged from 2007.

Euro Area

FDI: reported bilateral FDI assets and liabilities are measured at book value. To obtain market value estimates of the Euro area's bilateral direct investment positions, we use market value data derived from partner countries' reported assets and liabilities vis-à-vis the Euro area. Bilateral positions are imputed from the following countries: Australia, Canada, China, Denmark, Japan, New Zealand, Norway, Singapore, Sweden, Switzerland, United Kingdom and the United States. The Euro area total is calculated as the sum of the individual member countries bilateral positions.

Portfolio equity and debt: based on reported and derived portfolio equity/debt assets and liabilities available in IMF Coordinated Portfolio Investment Survey tables 1.1, 1.2 and 5.1, 5.2. The Euro are total is calculated as the sum of the individual member countries bilateral positions, netting-out the intra Euro area positions.

Foreign exchange reserves: we use the 2007 currency composition in Milesi-Ferretti, Strobbe and Tamirisa (2010) and, for 2008, assume that the currency shares are unchanged from 2007.

Hong Kong

FDI: we use tables 050 and 048 on the geographical breakdown of outward and inward FDI published by the Census and Statistics Department of the Government of Hong Kong. (http://www.censtatd.gov.hk/hong_kong_statistics)

Portfolio equity and debt: based on reported and derived portfolio equity/debt assets and liabilities available in IMF Coordinated Portfolio Investment Survey tables 1.1, 1.2 and 5.1, 5.2.

Foreign exchange reserves: we use the 2007 currency composition in Milesi-Ferretti, Strobbe and Tamirisa (2010) and, for 2008, assume that the currency shares are unchanged from 2007.

India

FDI: reported bilateral FDI assets and liabilities are measured at book value. To obtain market value estimates of India's bilateral direct investment positions, we use market value data derived from partner countries' reported assets and liabilities vis-à-vis India. Bilateral positions are imputed from the following countries: Australia, Canada, China, Denmark, Japan, New Zealand, Norway, Singapore, Sweden, Switzerland, United Kingdom and the United States.

Portfolio equity and debt: based on reported and derived portfolio equity/debt assets and liabilities available in IMF Coordinated Portfolio Investment Survey tables 1.1, 1.2 and 5.1, 5.2.

Foreign exchange reserves: we estimate the currency composition of reserves based on the aggregate currency shares for emerging markets in the IMF COFER database.

Japan

FDI: we use the geographical breakdown of outward and inward FDI provided in the Bank of Japan publication "Regional direct investment position assets and liabilities (end of 2009)" (http://www.boj.or.jp/en/statistics/br/bop/index.htm/)

Portfolio equity and debt: based on reported and derived portfolio equity/debt assets and liabilities available in IMF Coordinated Portfolio Investment Survey tables 1.1, 1.2 and 5.1, 5.2.

Foreign exchange reserves: we use the 2007 currency composition in Milesi-Ferretti, Strobbe and Tamirisa (2010) and, for 2008, assume that the currency shares are unchanged from 2007.

Other advanced

FDI: For Australia we use table 2, "Foreign Investment in Australia, Level of Investment by country and Country Groups by type of investment and year", and table 5 "Australian Investment Abroad, Level of Investment by country and Country Groups by type of investment and year" provided by the Australian Bureau of Statistics (http://www.abs.gov.au/AUSSTATS). For Denmark we use the geographical breakdown provided in table 3 "Direct Investments broken down by country" provided by the central bank of Denmark (http://www.nationalbanken.dk). For New Zealand we use the geographical breakdown provided in table 3: "Stock of direct investment by country" in the "Balance of Payments and International Investment Position: Year ended 31 March 2010" provided by Statistics New Zealand (http://www.stats.govt.nz). For Sweden and Norway we obtain the geographical breakdown of direct investment from the OECD (http://stats.oecd.org/BrandedView.aspx?oecd_bv_id=idi-data-en&doi=data-00337-en).

Portfolio equity and debt: based on reported and derived portfolio equity/debt assets and liabilities available in IMF Coordinated Portfolio Investment Survey tables 1.1, 1.2 and 5.1, 5.2. The country group total is calculated as the sum of the individual member countries bilateral positions.

Foreign exchange reserves: we use the 2007 currency composition in Milesi-Ferretti, Strobbe and Tamirisa (2010) and assume that the 2008 currency shares are unchanged from 2007.

Russia

FDI: reported bilateral FDI assets and liabilities are measured at book value. To obtain market value estimates of Russia's bilateral direct investment positions, we use market value data derived from partner countries' reported assets and liabilities vis-à-vis Russia. Bilateral positions are imputed from the following countries: Australia, Canada, China, Denmark, Japan, New Zealand, Norway, Sweden, Switzerland, United Kingdom and the United States.

Portfolio equity and debt: based on reported and derived portfolio equity/debt assets and liabilities available in IMF Coordinated Portfolio Investment Survey tables 1.1, 1.2 and 5.1, 5.2.

Foreign exchange reserves: we use the currency composition reported in the annual reports of the central bank of Russia (http://www.cbr.ru/eng/publ/main.asp?Prtid=God).

Singapore

FDI: for outward direct investment we use table 2 "Total Direct Investment Abroad by Country/Region, 2000-2009" of the report "Singapore's Investment Abroad 2009" and for inward direct investment we use table 2 "Foreign Direct Investment in Singapore by Country/Region, 1998-2008" of the report "Foreign equity investment in Singapore, 2008". Both reports are published by Statistics Singapore (http://www.singstat.gov.sg/pubn/business.html).

Portfolio equity and debt: based on reported and derived portfolio equity/debt assets and liabilities available in IMF Coordinated Portfolio Investment Survey tables 1.1, 1.2 and 5.1, 5.2.

Foreign exchange reserves: we use the 2007 currency composition in Milesi-Ferretti, Strobbe and Tamirisa (2010) and assume that the 2008 currency shares are unchanged from 2007.

Switzerland

FDI: we rely on the geographical composition provided in table 1.2 "Swiss direct investment abroad by country" (http://www.snb.ch/en/iabout/stat/statpub/fdi/stats/fdi/fdi_ChDirAus_LgKapBe) and table 2.2 "Foreign direct investment in Switzerland, by country" (http://www.snb.ch/en/iabout/stat/statpub/fdi/stats/fdi/fdi_AusDirCh_KapBeHL) published by the Swiss National Bank.

Portfolio equity and debt: based on reported and derived portfolio equity/debt assets and liabilities available in IMF Coordinated Portfolio Investment Survey tables 1.1, 1.2 and 5.1, 5.2.

Foreign exchange reserves: we use the currency allocation of official reserves provided in chapter 5 of the annual reports of the Swiss National Bank (http://www.snb.ch/en/iabout/pub/annrep/id/pub_annrep)

United Kingdom

FDI: we use the geographical composition provided in table 3.1 "Net FDI international investment position abroad analysed by area and main country, end 2000 to end 2009" and table 6.1 "Net FDI International positions in the United Kingdom analysed by area and main country, 2000 to 2009" in the "Foreign Direct Investment Business Monitor MA4" published by the Office of National Statistics (http://www.statistics.gov.uk/statbase/product.asp?vlnk=9614).

Portfolio equity and debt: based on reported and derived portfolio equity/debt assets and liabilities available in IMF Coordinated Portfolio Investment Survey tables 1.1, 1.2 and 5.1, 5.2.

Foreign exchange reserves: we use the currency composition of the UK government's official reserves published in the quarterly annex to the "UK International Reserves & Foreign Currency Liquidity Template" (http://www.bankofengland.co.uk/statistics/reserves/intro.htm).

United States

FDI: for bilateral outward direct investment we rely on the table "U.S. direct Investment Abroad: Selected Items by Detailed Country, 2005-2009" (http://www.bea.gov/international/di1usdbal.htm) and for bilateral inward direct investment on the table "Foreign Direct Investment in the United States: Selected Items by Detailed Country, 2005-2009" (http://www.bea.gov/international/xls/LongCountry.xls) both published by the Bureau of Economic Analysis.

Portfolio equity and debt: for portfolio equity and debt assets we use IMF CPIS tables 1.1 and 1.2. Portfolio equity and debt liabilities were obtained from the Survey on Portfolio Holdings of U.S. Securities as of June 2007 and June 2008, published by the U.S. Treasury (http://www.treasury.gov/resource-center/data-chart-center/tic/Pages/fpis.aspx). Positions are updated using the monthly estimates provided in Bertaut and Tryon (2007) (http://www.federalreserve.gov/pubs/ifdp/2007/910/default.htm).

Foreign exchange reserves: we use the 2007 currency composition in Milesi-Ferretti, Strobbe and Tamirisa (2010) and assume that the 2008 currency shares are unchanged from 2007.

B.3 FDI market value estimation

We denote market value by MV, book value by BV, current cost by CC and historical cost by HV. The list of countries providing both aggregate and bilateral FDI positions data at MV includes:

- Australia (IIP & bilateral positions; see http://abs.gov.au/austats/abs@.nsf/mf/5370.0.55.001)

- Hong Kong (IIP & bilateral positions)

- New Zealand (IIP & bilateral positions, except for some firms that provide positions at BV; see http://www.unctad.org/sections/dite_fdistat/docs/wid_cp_nz_en.pdf)

- Norway (IIP & bilateral positions; see http://www.ssb.no/intinvpos_en/about.html)

For the following countries, we estimate both the aggregate FDI positions and the bilateral positions at MV:

- Canada (IIP & bilateral positions = BV, we estimate MV, initial 2005 market to book value ratio provided by Simard and Boulay (2006))

- China (IIP & bilateral positions = BV, we estimate MV, initial 2004 aggregate and bilateral FDI positions are at market value)

- Denmark (IIP & bilateral positions = BV, we estimate MV, initial 2006 market value estimate provided by Kumah, Damgaard and Elkjaer (2009))

- Switzerland (IIP & bilateral positions = BV, we estimate MV, initial 2005 market value estimate provided by Stoffes and Tille (2009))

- United Kingdom (IIP & bilateral positions = BV, we estimate MV, initial 2005 market value estimate provided by Kubelec, Orskaug and Tanaka (2007))

Countries providing aggregate FDI data at market value along with official valuation series:

- Japan (IIP & bilateral positions = BV, Bank of Japan provides estimate of aggregate FDI abroad & inward market-to-book value ratio, we use this to obtain bilateral positions at MV)

- Sweden (IIP & bilateral positions = BV, also provides estimate of aggregate FDI at MV, we use these to obtain bilateral positions at MV)

- United States (IIP = CC, BEA bilateral positions = HC, market-to-HC ratio provided by BEA, we use these to obtain bilateral positions at MV)

The following countries do not report aggregate FDI at MV and we are unable to compute our own estimates. Reported bilateral positions are at BV.

- Brazil (IIP = BV, bilateral positions at MV imputed from partner countries)

- Emerging Asia (IIP = BV, bilateral positions at MV imputed from partner countries)

- Euro Area (IIP & bilateral = BV, bilateral positions at MV imputed from partner countries)

- India (IIP = BV, bilateral positions at MV imputed from partner countries)

- Russia (IIP = BV, bilateral positions at MV imputed from partner countries)

Methodology for market value estimation:

1. we start from an initial estimate of the aggregate FDI abroad/inward position at MV (usually for 2005, provided by statistical agency or other, see above).

2. multiply the date t position in USD with the weighted average of the destination countries' USD ex-dividend equity index returns, with weights corresponding to the date t FDI portfolio weights (FDI abroad); or home country USD equity index return (inward FDI)

3. add USD financial outflow/inflow to obtain date t+1 position at MV

4. calculate market-to-book value ratio for each date

5. calculate bilateral positions at MV using 4)

Due to data limitations, we are unfortunately unable to obtain full bilateral FDI balance sheets at market value for those countries where positions were imputed from partner country FDI assets and liabilities. Instances with bilateral positsions unavailable for at least one country of a source/partner country pair are indicated with 'na'in the matrice of bilateral valuation gains and losses on the net FDI portfolio.
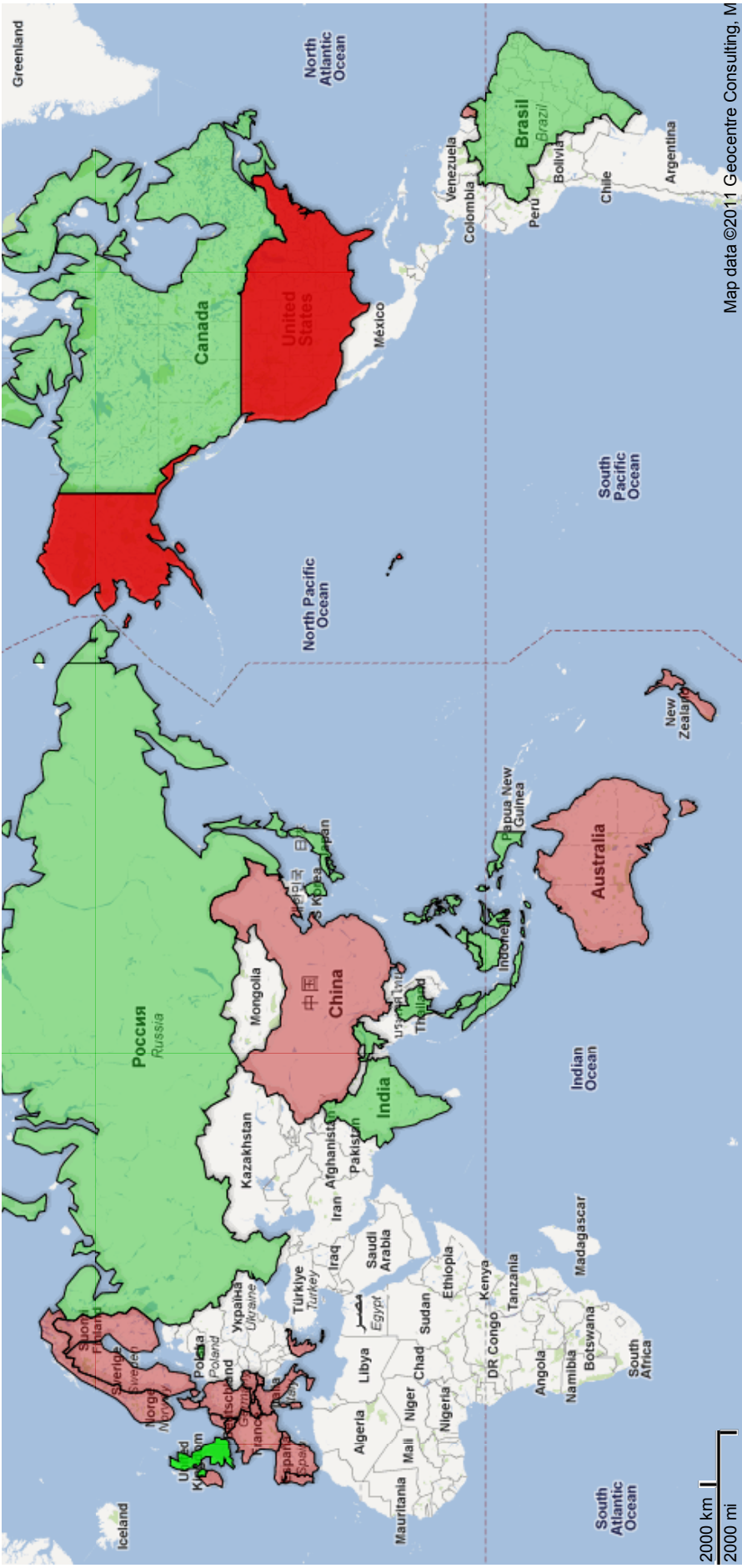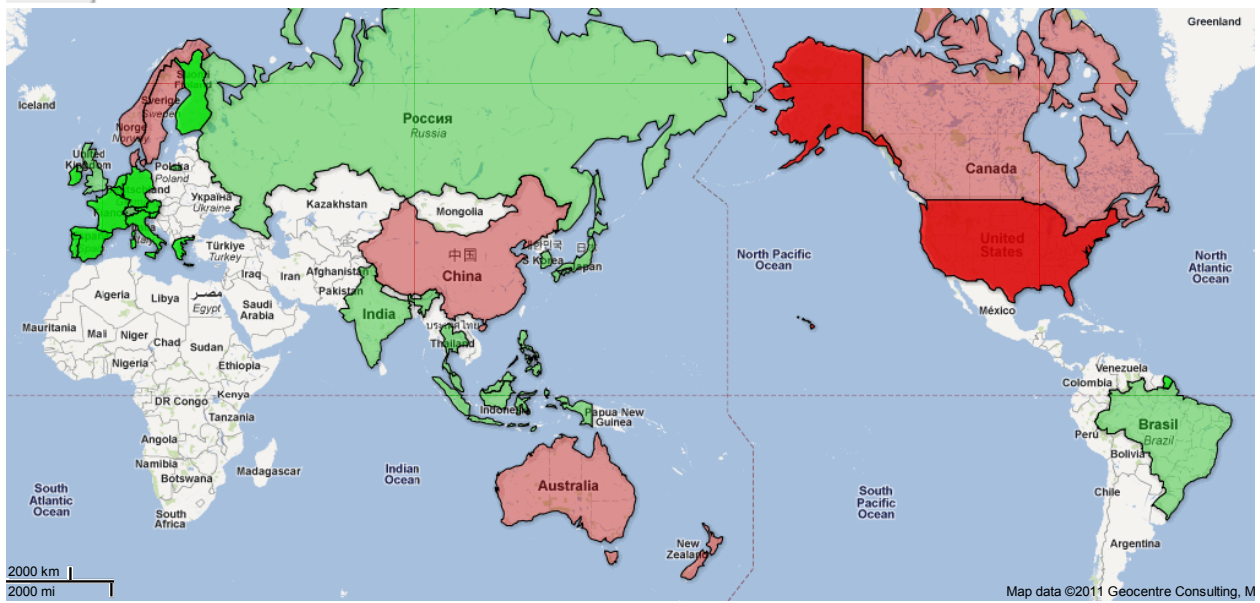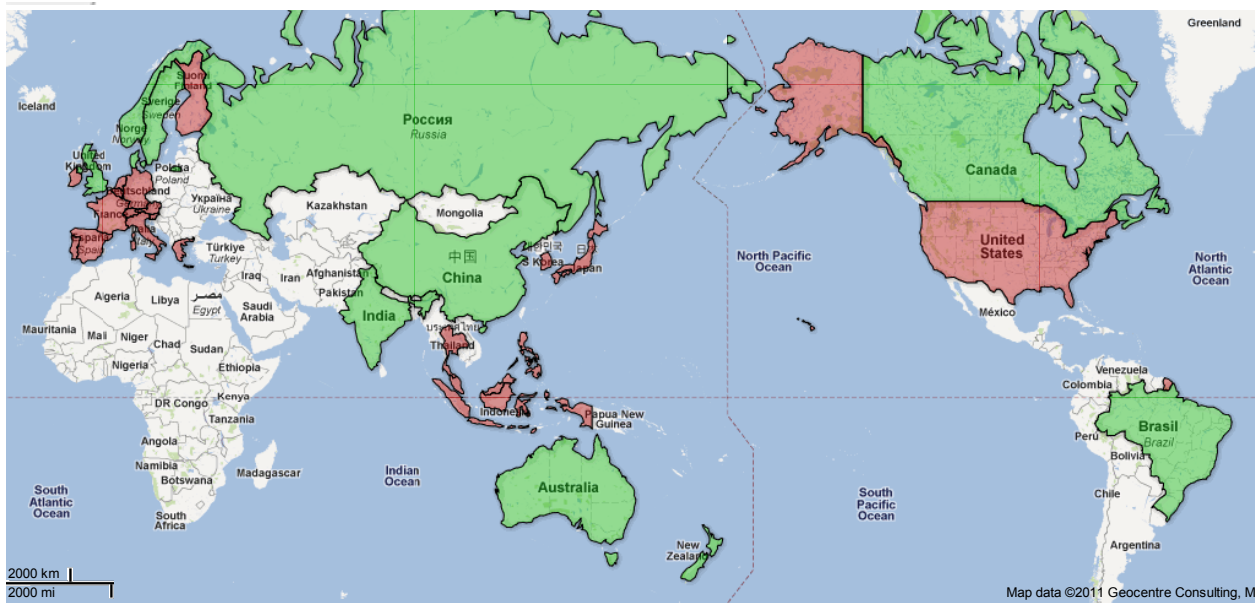
Figure 1: Heat Map of Valuation Gains and Losses

The figure reports total valuation gains/losses. **Dark red**: losses in excess of $600bn. Light red: losses smaller than $600bn. Light green: gains smaller than $400bn. **Dark green**: gains in excess of $400bn.

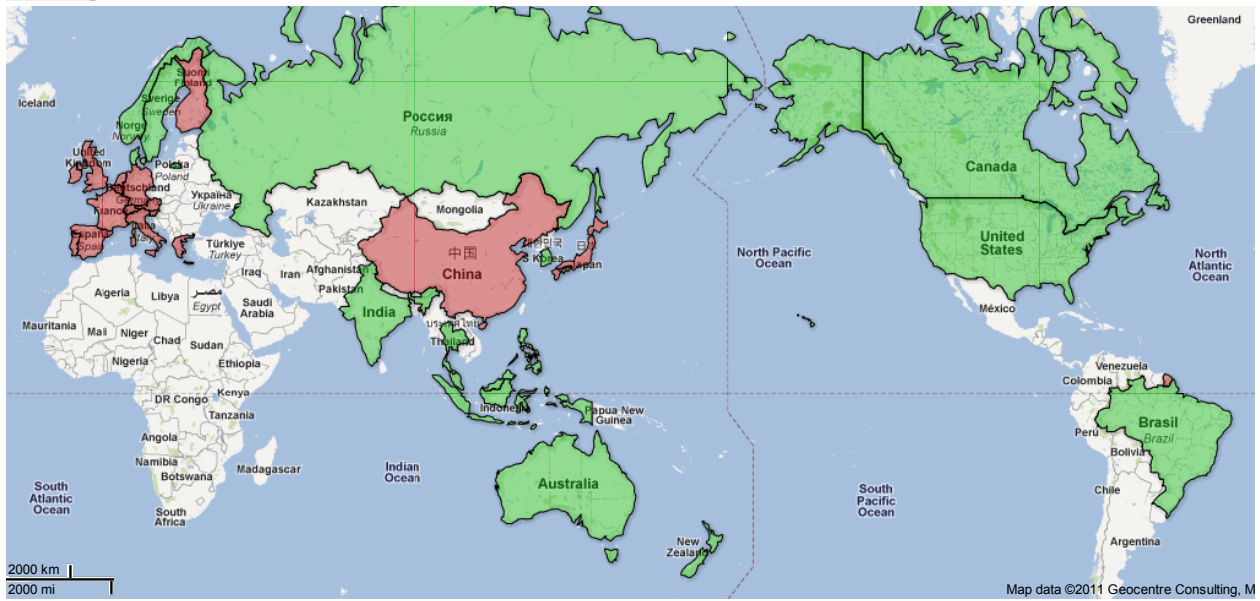48

Figure 2: Heat Map of Valuation Gains and Losses

(a) Portfolio Equity

(b) Portfolio Debt

The figure reports portfolio gains/losses for equity (panel (a)) and debt (panel(b)). **Dark red**: losses in excess of $600bn. Light red: losses smaller than $600bn. Light green: gains smaller than $400bn. **Dark green**: gains in excess of $400bn.

Figure 3: Heat Map of Valuation Gains and Losses

(a) Direct Investment
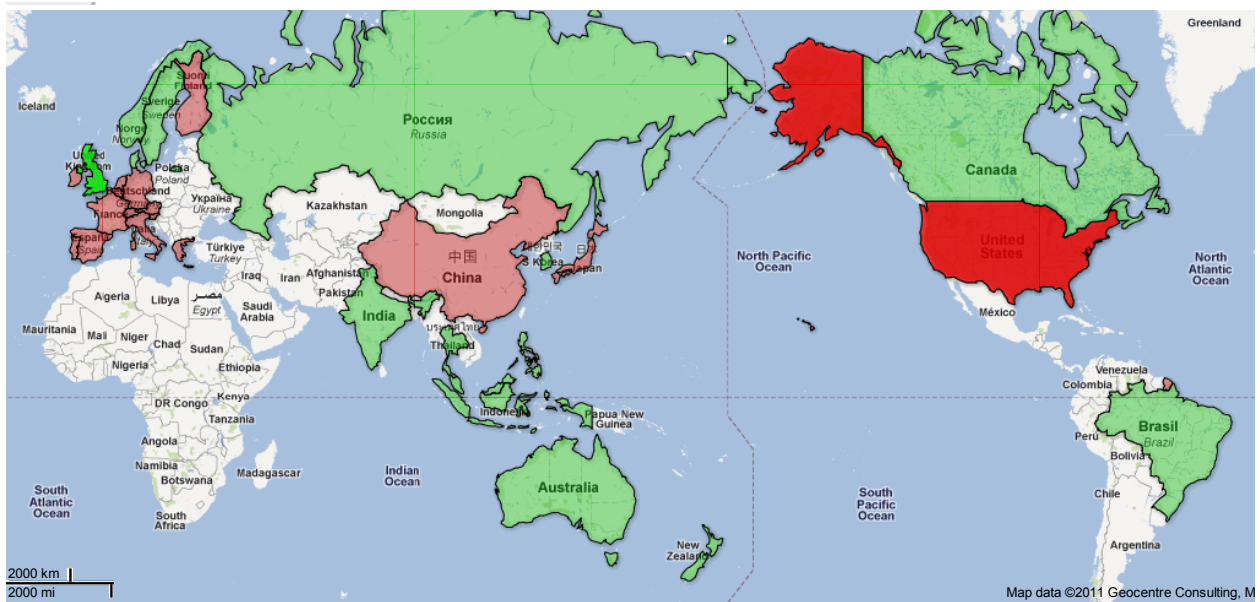
(b) Currency Gains/Losses

The figure reports direct investment valuation gains/losses (panel (a)) and currency gains/losses (panel (b)). **Dark red**: losses in excess of $600bn. Light red: losses smaller than $600bn. Light green: gains smaller than $400bn. **Dark green**: gains in excess of $400bn.
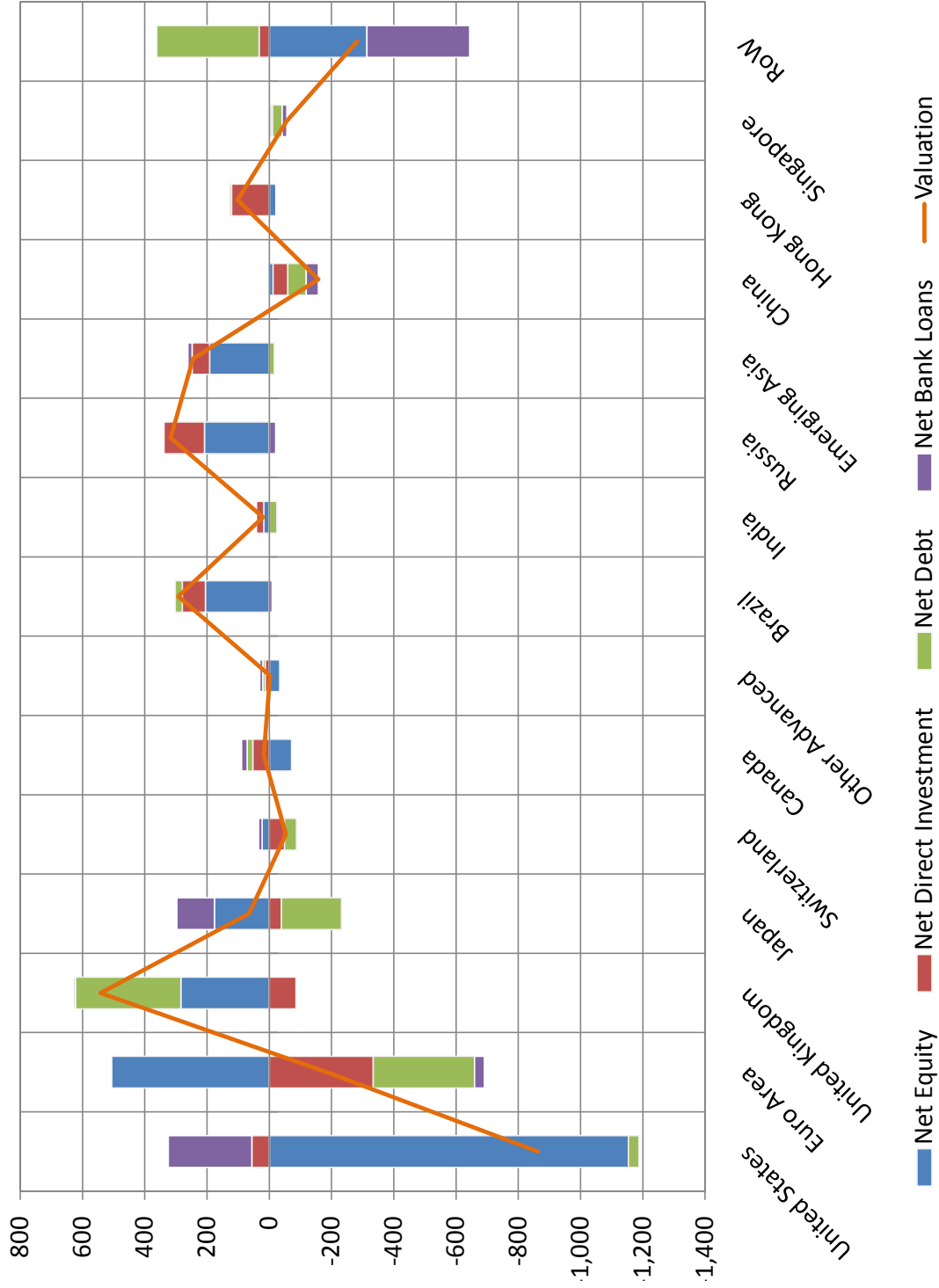
Figure 4: The Geography of Wealth Transfers

Author's Calculations. The figure reports the external valuation gain(+)/loss(-) between 2007:4 and 2008:4, broken down by asset class (equity, direct investment, debt and bank loans) and corrected for current account flows over the same period. See appendix for data sources.
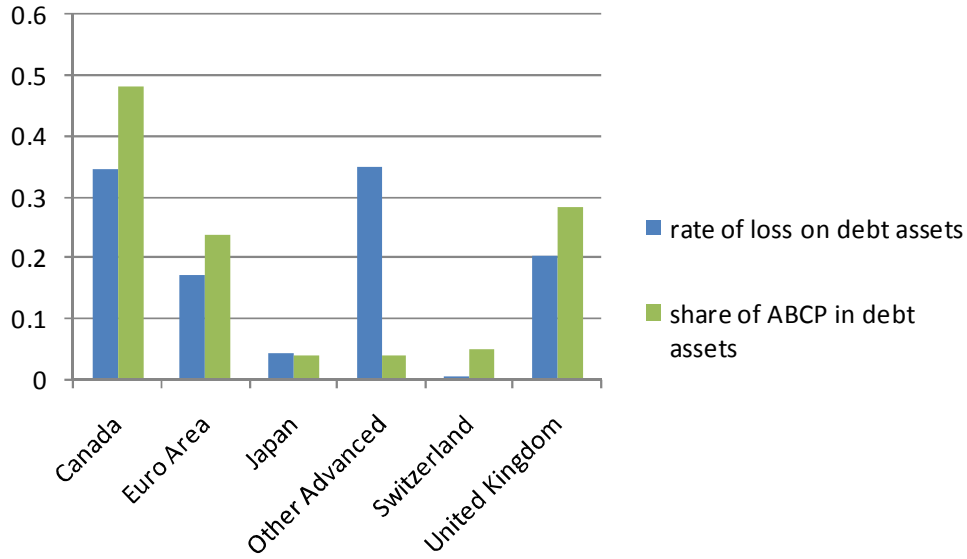
Figure 5: Exposure to ABCP and Portfolio Debt Losses, by country

The figure reports for each country or group the share of ABCP in that country debt claims position in 2007, as well as the rate of loss on debt assets between 2007:4 and 2008:4. Source: Authors' calculations and Acharya and Schnabl (2010)
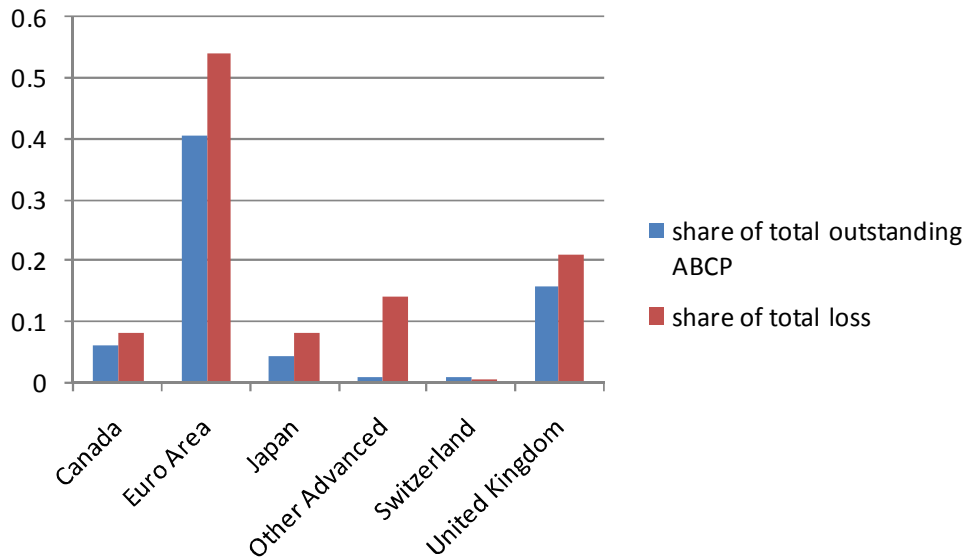

Figure 6: Exposure to ABCP and Portfolio Debt Losses, fraction of total

The figure reports for each country or group the share of ABCP in total ABCP hholdings in 2007, as well as the share of overall loss on debt assets between 2007:4 and 2008:4. Source: Authors' calculations and Acharya and Schnabl (2010)
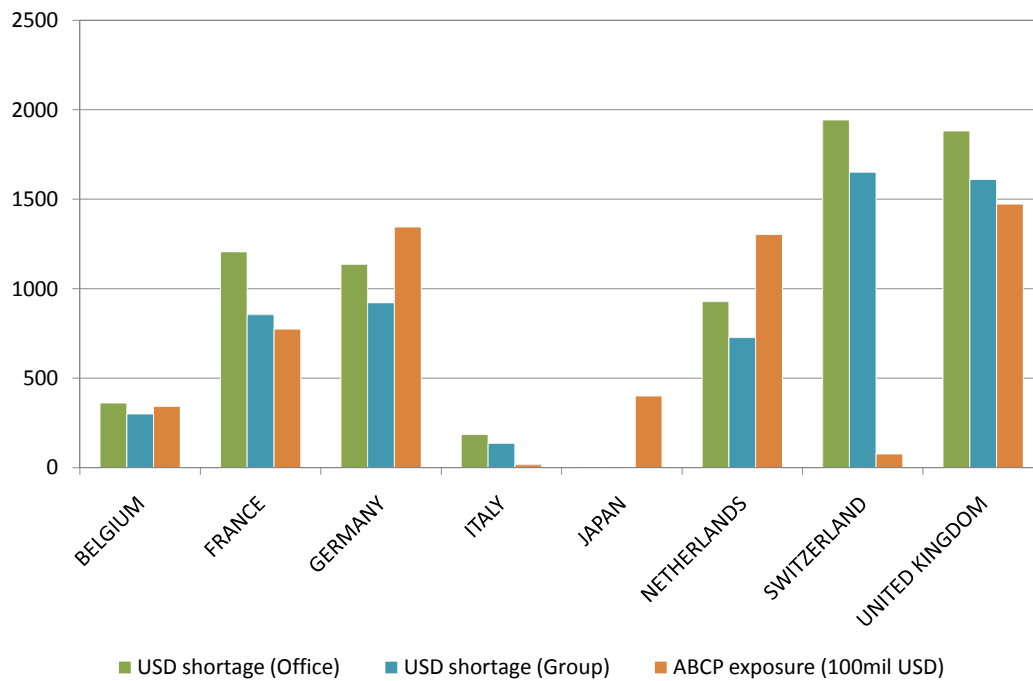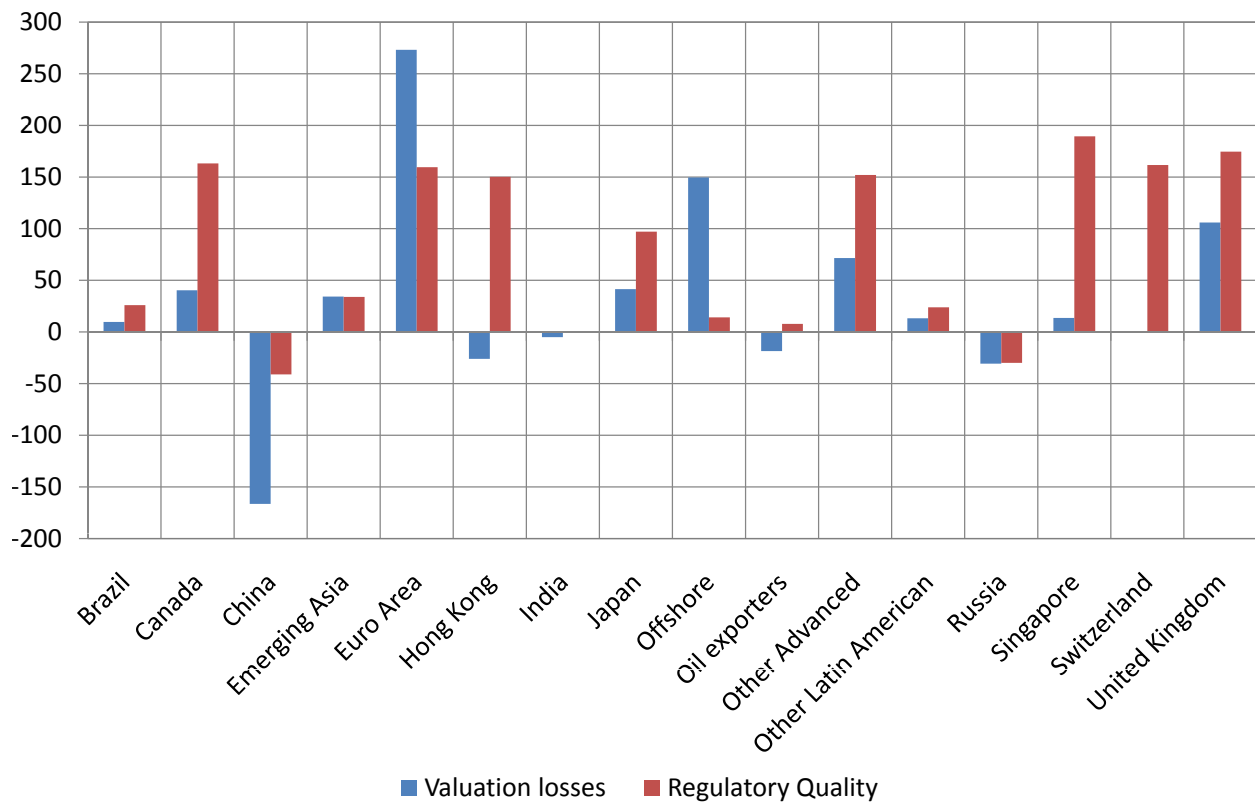
Figure 7: Dollar Shortage and ABCP exposure

The figure reports the upper limit of the dollar shortage measures constructed at the office and group level together with ABCP exposure data at the country level. Source: McGuire and von Peter (2009) and Acharya and Schnabl (2010)

Figure 8: Regulatory Environment and Valuation Losses

The figure reports the index of regulatory quality from Kaufmann, Kraay and Mastruzzi (2010), together with total valuation losses (+) or gains (-)